1926–27.

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

FIRST ANNUAL REPORT

OF

THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

FOR THE

Period from the 13th April, 1926, to the 30th June, 1927.

Presented pursuant to Statute; ordered to be printed, 9th December, 1927.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

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G. Lightfoot, M.A.

(Covering Letter.)

COMMONWEALTH OF AUSTRALIA.

Council for Scientific and Industrial Research,
314 Albert-street,
East Melbourne,
17th November, 1927.

The Rt. Hon. S. M. Bruce, P.C., M.C.,
Prime Minister,
Canberra, Federal Capital Territory.

DEAR SIR,

In accordance with the provisions of the *Science and Industry Research Act* 1920–1926 (section 18), we beg to forward herewith the First Annual Report of the Council covering the period from the 13th April, 1926 (the date on which the first meeting of the Executive Committee of the Council was held) to the 30th June, 1927.

Section 19 of the Act provides that the Report shall be laid before both Houses of Parliament within thirty days after the receipt thereof if the Parliament is then sitting, and if not, within thirty days after the next meeting of the Parliament.

Yours faithfully,
A. C. D. RIVETT,
Deputy Chairman.
G. LIGHTFOOT,
Secretary.

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COMMONWEALTH OF AUSTRALIA.

Council for Scientific and Industrial Research.

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I.—THE COUNCIL.

In 1926 steps were taken by the Commonwealth Government for the re-organization of the Institute of Science and Industry, which had been established by an Act passed in 1920. The principal object of the *Science and Industry Research Act* 1926 was to obviate two main difficulties which had existed previously, viz., (1) a scheme of control which was somewhat too centralized; and (2) lack of necessary funds. By the *Science and Industry Research Act* 1926, the control of the Commonwealth's activities in the field of scientific and industrial research was placed in the hands of a Council, which is a corporate body consisting of—

(*a*) Three members nominated by the Commonwealth Government (one being Chairman), and appointed by the Governor-General.

(*b*) The Chairman of each State Committee of the Council.

(*c*) Other members co-opted by reason of their scientific knowledge.

Provision was made for the co-option of members in order to permit of the inclusion in the Council of representatives of important fields of science and industry, who might otherwise have been omitted. The Act provides that the Council shall meet at such times and places as the Minister determines. Owing to the difficulty in arranging for the attendance of members at frequent meetings of the Council, and to the expense which would thus be involved, there is an Executive Committee which consists of the three members nominated by the Commonwealth Government, and which exercises, between meetings of the full Council, all the powers and functions of the Council. A copy of the *Science and Industry Research Act* 1920–1926, which comprises the *Institute of Science and Industry Act* 1920, as amended by the *Science and Industry Research Act* 1926, is printed as Appendix I. of this Report.

II.—THE STATE COMMITTEES.

An important feature of the Act is the provision made for the appointment of State Committees, whose main functions are to advise the Council regarding the general business of the Council, and any particular matter of investigation and research. Regulations have been prescribed under the Act providing that each of these Committees shall consist of a Chairman selected by the Commonwealth Government; three members nominated by the State Government from the staffs of its scientific departments; and three members, eminent in science, of whom at least two shall be members of the staff of the local University, all three being nominated by the Australian National Research Council. In addition, the Chairman and the six members thus appointed have the right to nominate three members associated with industry, while further members, not exceeding six, may be co-opted by reason of their special qualifications, with the consent of the Executive Committee.

The Regulations provide that both the Chairman and the nine nominated members of a State Committee shall be appointed for a term of three years. In order to obviate the retirement of all the nominated members at the same time, provision is made in the Regulations for their retirement in rotation. Co-opted members hold office for such terms, not exceeding three years, as are determined by the State Committees co-opting them. A list of the members of the State Committees is given at the end of this Report. A copy of the Regulations which have been prescribed under the Council's Act is printed in Appendix II. of this Report.

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III.—POWERS AND FUNCTIONS OF THE COUNCIL.

The powers and functions of the Council as defined by the Act are as follows :—

(*a*) The initiation and carrying out of scientific researches in connexion with, or for the promotion of, primary or secondary industries in the Commonwealth.

(*b*) The training of research workers and the establishment and awarding of industrial research studentships and fellowships.

(*c*) The making of grants in aid of pure scientific research.

(*d*) The recognition or establishment of associations of persons engaged in any industry or industries for the purpose of carrying out industrial scientific research, and the co-operation with and the making of grants to such associations when recognized or established.

(*e*) The testing and standardization of scientific apparatus and instruments, and the carrying out of scientific investigations connected with standardization of apparatus, machinery, materials, and instruments used in industry.

(*f*) The establishment of a Bureau of Information for the collection and dissemination of information relating to scientific and technical matters.

It is also provided that the Council shall act as a means of liaison between the Commonwealth and other countries in matters of scientific research.

IV.—CO-OPERATION WITH STATES.

The Council is intended to supplement, and not take the place of, existing scientific industrial research institutions and departments in the several States, and the Act specifically states that the Council shall, as far as possible, co-operate with existing State organizations in the co-ordination of scientific investigations with a view to—

(*a*) the prevention of unnecessary overlapping, and

(*b*) the utilization of facilities and staffs available in the States.

The Commonwealth Government desired to bring into being a real co-operation between all those engaged in applying science and research to industry. It is gratifying to know that the States have accepted this position, and that they are already co-operating whole-heartedly with the Council. Information given in later parts of this Report indicates that nearly all of the more important investigations which the Council has initiated are being conducted in co-operation either with State Government Departments, the Universities, or other existing institutions.

V.—THE SCIENCE AND INDUSTRY INVESTIGATION FUND.

By the Act of 1926, a sum of £250,000 was appropriated for the purposes of scientific and industrial investigations carried out in pursuance of the Act. The appropriation of that sum, which has been paid into a Trust Account, obviates the necessity for Parliament being asked to make annual votes for the purpose of the Council's work. Parliamentary control over the operations of the Council is effected by a clause in the Act providing that no money can be expended from the Trust Account except in accordance with Estimates passed by Parliament. It has been announced that a further sum of £250,000 is to be appropriated for the purposes of the Trust Account from the Surplus Revenue for the financial year 1926–27.

VI.—APPOINTMENT OF OFFICERS.

The Act empowers the Council to appoint officers with the approval of the Minister. Officers are not subject to the Commonwealth Public Service Act, but are engaged for such periods, and are paid such salaries and allowances, and are subject to such conditions as the Council, with the approval of the Minister, determines. They are entitled to contribute to, and receive benefits under, the Commonwealth Superannuation Fund. Provision is made for the payment of bonuses in the case of discoveries or inventions being made by officers.

VII.—PRELIMINARY WORK OF THE COUNCIL.

Three series of meetings of the full Council have so far been held. Up to the 30th June, 1927, the Executive Committee had held 59 meetings. A list of the members of the Council and of its Executive Committee is given at the beginning of this report. In April, 1927, the Council suffered a very severe loss through the death of Mr. W. J. Newbigin, who had rendered services of the highest value as a member both of the Council and of the Executive Committee. Professor A. E. V. Richardson, Director of the Waite Agricultural Research Institute,

Adelaide, has been appointed to fill the vacancy caused by Mr. Newbigin's death. During Professor Richardson's absence abroad (to attend the Imperial Conference on the Co-ordination of Agricultural Research), Mr. C. S. Nathan, C.B.E., Vice-Chairman of the Development and Migration Commission, has been appointed a deputy member of the Council and of the Executive Committee.

The Chairman of the Council (Mr. G. A. Julius) left for England at the beginning of June, chiefly on private business. He will be absent until the end of March, 1928. During this period Mr. Julius will come into personal contact with leaders in the Department of Scientific and Industrial Research and other research organizations in Great Britain, and will be able to carry out valuable work for the Council. He will return via America.

At the early meetings both of the Council and the Executive Committee, a great deal of the time was necessarily devoted to initial matters of organization, and the procedure to be followed in promoting research work. At the first meeting of the Council, it was decided that efforts should for the present be concentrated primarily on the organization of research work in the following five main groups of problems :—

1. Animal pests and diseases.
2. Plant pests and diseases.
3. Fuel problems, especially liquid fuels.
4. Preservation of foodstuffs, especially cold storage.
5. Forest products.

Moreover, a considerable amount of time and attention had to be devoted to making a survey of the whole field of industrial research to ascertain the most pressing problems ; their economic importance ; what facilities in the way of laboratories, equipment, and staff were available ; whether they were already being attacked by existing institutions ; and, if so, in what way these efforts could best be supplemented.

In order to carry out this prelminary work efficiently, it was found necessary to secure the temporary and part-time services of persons who had special knowledge and experience in certain of the major branches of science and industry concerned. Thus, in regard to plant problems the services of Professor T. G. B. Osborn, Professor of Botany, Adelaide University, were obtained in order that he might visit each of the States, and collect definite information as to the problems, the centres at which research work is being conducted in the several States, the outstanding groups of problems on which work should be undertaken by the Council, and the most suitable methods of attack. Again, as regards animal diseases and pests, the services of Professor H. A. Woodruff, Professor of Veterinary Pathology, Melbourne University, were secured. Similarly, Professor J. A. Prescott, Professor of Agricultural Chemistry, University of Adelaide, has been appointed as the Council's adviser on soil problems. In other cases where it was found that the services of a suitably qualified authority were not available in Australia, the Council has arranged for the services of certain officers to be obtained from abroad to visit Australia, and furnish reports. Thus arrangements were made with the British Department of Scientific and Industrial Research for Dr. Franklin Kidd, of the Low Temperature Research Station, Cambridge, to visit this country, and to furnish a report on the organization of research work on the cold storage and preservation of perishable food products. In making this arrangement, the Council was influenced largely by the fact that the organization of any comprehensive investigations on cold storage problems in Australia would necessitate the closest co-operation with authorities engaged in similar work in Great Britain. Arrangements were also made by the Council for Associate Professor W. J. Young, Department of Bio-Chemistry, University of Melbourne, to collaborate with Dr. Kidd in his inquiries and report. Similarly, as regards the whole question of the organization and development of forest products investigation and the proposed establishment of a Commonwealth Forest Products Laboratory, the Council arranged for a visit by Mr. A. J. Gibson, an officer of the Indian Forest Service.

Whilst it is realized that the above course, in some cases, involves considerable delay in the actual initiation of research work, it was considered essential to obtain authoritative information at first hand in order to enable the foundations for future operations to be laid securely.

VIII.—AGRICULTURAL RESEARCH.

1. *Conference on Agricultural Research.*—A great deal of attention has been given by the Council to the possibility of initiating new researches on agricultural problems, and supplementing, where necessary, the admirable work of the State Departments. It was perfectly clear that, in this field perhaps more than in any other, close co-ordination was essential if overlapping and waste of effort were to be avoided. The Council therefore convened in March, 1927, an Agricultural Conference to advise it as to what place it could best fill in the field of agricultural research, and as to how it could best co-operate with the State Departments.

The Conference was attended by the Heads of each of the State Departments of Agriculture (each accompanied by one of his senior officers); by the Professors of Agriculture of the Australian Universities; by one or two other agricultural experts; and by representatives of the Council. It was of the opinion that, in view of the number and magnitude of the problems concerning the agricultural and live-stock industries of Australia, Commonwealth participation in agricultural research is desirable; that there are many problems which are national in range or scope, fundamental in character, and which require concentration, effort, and highly specialized research for their solution; and that such problems are specially suited for investigation by the Commonwealth. The Conference was also of the opinion that the Council could render a service to the agricultural institutions of the Commonwealth by acting as a clearing house for information on research projects in progress in State institutions and Universities, and that it could also render a service by issuing a Journal of Australian Scientific Research, which would afford a means for the publication of papers on agricultural subjects which are too technical for inclusion in State Departmental journals. The Conference considered that the way in which the Council could best serve Australia in the matter of agricultural advancement was by the establishment of a relationship of co-operation and collaboration with the State Departments of Agriculture, the Universities, and other institutions concerned with agriculture and live-stock interests. Throughout all the discussion that took place at the Conference, it was evident that the States would welcome the advent of the Council into agricultural research in certain important directions, and that they would be very willing to co-operate closely in that work.

In order to effect the desirable co-operation and collaboration between the Commonwealth and the State Departments, the Conference recommended that a Standing Committee on Agriculture should be appointed, consisting of the permanent Heads of the State Departments of Agriculture, and representatives of the Council, and that the functions of that Committee should be to act as the advisory and consultative body on matters relative to agricultural and live-stock research undertaken by the Commonwealth.

The resolutions passed by the Agricultural Conference are published at length in Appendix III. of this Report.

2. *Standing Committee on Agriculture.*—Effect was duly given to the recommendation of the Agricultural Conference for the appointment by the Council of a Standing Committee on Agriculture, and the first meeting of the Committee was held in Adelaide on the 25th May, 1927, when the following were present :—

Permanent Heads of the State Departments of Agriculture—

Dr. S. S. Cameron, Victoria (Chairman).
Mr. G. D. Ross, New South Wales.
Mr. E. Graham, Queensland.
Professor A. J. Perkins, South Australia.
Mr. G. L. Sutton, Western Australia.
Mr. F. E. Ward, Tasmania.

Representatives of the Council—

Professor T. G. B. Osborn, University of Adelaide.
Professor J. Prescott, Waite Agricultural Research Institute.
Professor A. E. V. Richardson, Waite Agricultural Research Institute.
Professor A. C. D. Rivett, Executive Committee of Council.
Mr. G. A. Cook (Secretary).

The first meeting of the Standing Committee was of an initial nature. The more important matters discussed were—

(*a*) Publication by the Council of a quarterly Journal.
(*b*) Proposed investigations on the cultivation of tobacco in Australia.
(*c*) Proposed investigations on poison plants in Australia; and
(*d*) Imperial Conference on the Co-ordination of Agricultural Research.

Each of these matters is referred to in an appropriate place later in this Report.

3. *Register of Agricultural Research.*—In accordance with the recommendation of the Agricultural Conference action has been taken by the Council for the compilation of a register of agricultural researches in progress throughout the Commonwealth. For that purpose copies

of forms have been sent to the State Agricultural Departments and other institutions concerned asking for information regarding each research project to be furnished with respect to the following :—

(1) Names of principal investigator and chief assistants.
(2) Place where work is being carried out.
(3) Title and objects of investigation.
(4) Co-operation (if any) with other bodies.
(5) Progress of work.
(6) Impediments, if any, to progress of work.

The State Agricultural Departments and other institutions concerned have also been asked to suggest subjects for investigation either by the Council itself or by the Council acting in co-operation with the States. When the desired returns are completed a register will be compiled, and a copy of it sent to each of the Departments and other institutions concerned. In this way it is hoped, not only that the Council will be able to render valuable service by acting as a clearing-house of information, but also that specific suggestions will be forthcoming as to the problems on which the Council can usefully undertake research work. The whole position will then be fully discussed at the next meeting of the Standing Committee on Agriculture.

4. *Imperial Conference on the Co-ordination of Agricultural Research.*—Towards the end of 1925, the question of the co-ordination of agricultural research throughout the Empire engaged the attention of the Agricultural Research Council of Great Britain. As a result, it was recommended that a Conference of representatives of all parts of the Empire be held in the autumn of 1927. This proposal was considered by the Imperial Conference of 1926, which fully endorsed it, and urged the respective Governments concerned to give their fullest possible support.

The Conference will accordingly be held in London, commencing on the 4th October, 1927, and lasting for about a month subsequent to that date. Its main purpose will be the consideration of machinery for securing effective co-operation in agricultural research throughout the Empire. The questions coming up for discussion will, therefore, be such as the following :—Should the system of bureaux now exemplified by the Bureaux of Entomology and Mycology be extended to other branches of agricultural science ? By what methods of publication, circulation, &c., can the progress of, and results of, research best be made available throughout the Empire ? How far can the supply and training of scientific workers be organized on an Imperial basis ? What arrangements should be made for the interchange of workers in the different parts of the Empire ?

The Commonwealth will be represented at the Conference by three representatives, as follows :—Mr. G. A. Julius, Chairman, Council for Scientific and Industrial Research ; Dr. S. S. Cameron, Director, Victorian Department of Agriculture ; and Professor A. E. V. Richardson, Director, Waite Agricultural Research Institute.

5. *Proposed Tropical Agricultural Research Institute.*—The Council is formulating plans for a comprehensive campaign of investigation of tropical agricultural problems. The British Empire Marketing Board has offered to contribute £25,000 towards the capital cost, and £5,000 per annum towards the annual maintenance on a £1 for £1 basis with the Commonwealth for the establishment of a Tropical Agricultural Research Institute in Queensland. This offer has been accepted by the Commonwealth Government. The creation of such an Institute is obviously of immense importance in connexion with the development of the tropical parts of Australia. The Council is drawing up plans, in collaboration with the British Empire Marketing Board, for the work and organization of the Institute, its capital cost, annual expenditure, equipment, and staff.

IX.—INVESTIGATIONS ON PLANT PROBLEMS.

1. *Prickly-pear Pest—Biological Control.*—One of the most important investigations on which the Council is engaged is the attack on the prickly-pear pest, which covers an area of about 60,000,000 acres in New South Wales and Queensland, that is, about three times the total area cultivated in Australia under all forms of crops. The object of the investigations is to ascertain the practicability of the control and eradication of the pest by biological means, i.e., the introduction of insect enemies and fungous diseases which destroy the pear in other countries. The work was initiated by the former Advisory Council of Science and Industry in co-operation with the New South Wales and Queensland Governments. Various species of insects have been acclimatized, and exhaustive tests have been carried out to ascertain whether they will attack any plant other than prickly-pear. Under no circumstances is any species of insect liberated unless it passes all the tests. Moreover, there are many different kinds of prickly-pear in Australia, and most of the insects will not feed indiscriminately on all species. Experiments

had thus to be carried out to ascertain which insects will attack each of the more important species of pear. Again, the climatic conditions of different parts of the prickly-pear area vary considerably, so that it has been necessary to collect insects from various regions in America. The distribution of large numbers of certain species of insects is now proceeding, and is being carried out in close co-operation with the Queensland Prickly-pear Lands Commission and the Entomological Officers of the New South Wales Department of Agriculture. Naturally it will take a long time for them to establish themselves and multiply in sufficient numbers to cause any marked destruction of the pear over any considerable areas. Whilst, therefore, the process must be slow, the results recently obtained indicate that there is every reason to believe that ultimate success will be achieved.

A beginning has already been made in the investigation of fungous and bacterial diseases which attack the pear, and which, in the opinion of some authorities, are likely to be equally as effective as insects. In particular, investigations are being carried out in the United States of America and a survey is being made of the diseases which attack prickly-pear in that country.

It is said that the pear has been spreading during recent years at the rate of 1,000,000 acres annually. Even if the investigations result in doing no more than preventing the spread taking as low a value as 5s. an acre, the annual value of the work would be £250,000.

2. *Virus Diseases, &c., of Plants—Tomato Wilt.*—Another important investigation is that which the Council is carrying out on certain plant diseases under a co-operative agreement with the University of Adelaide at the Waite Agricultural Research Institute, South Australia. An insect-proof glasshouse has been erected for the purpose of carrying out research work on virus diseases, soil-borne fungous diseases, and possibly other diseases of plants. For the present, work is being concentrated on tomato wilt, a disease which originated near Melbourne in 1915, and which has spread to all the tomato-growing States. In certain years it has been very destructive over large areas, and in some localities has been so severe that whole plantations have been destroyed. The first object of the investigation is to ascertain the precise nature of the disease and the means by which it is transmitted. This object has already been attained, and it has been proved by Mr. H. A. Pittman, B.Agr.Sc., who is the Assistant Plant Pathologist engaged on the investigations and an officer of the Council, working under Mr. G. Samuel, that the disease is a virus disease transmitted by the onion or rose thrips (*Thrips tabaci* Lindeman). The larvae of this insect feed on the plants only for a few days and then drop off and enter the chrysalis stage. The disease does not manifest itself for from sixteen to twenty days, and this is perhaps the reason why the species of thrips had not previously been suspected to be the vector of the disease. Concurrently with the work on tomato wilt, the investigation of other plant diseases will be undertaken at the Waite Institute, and efforts will be concentrated on some other disease as soon as the intensive work on tomato wilt reaches a stage to justify transfer of concentration.

By the co-operative agreement under which these investigations are being conducted, the Council undertook to erect an insect-proof glasshouse in the grounds of the Waite Agricultural Research Institute (the glass-house is to remain the property of the Commonwealth, which may remove it), and to pay a sum of £1,000 per annum for the salaries of an assistant plant pathologist and a technical assistant, and for contingencies and miscellaneous expenditure. The University of Adelaide undertook to provide necessary equipment for the laboratory site of the investigations; to supply light, heat, and water ; to direct the investigations ; to provide field plots and gardening staff ; and to furnish reports and audited statements of expenditure. It was agreed that the arrangement should be continued indefinitely with such modifications as may from time to time be deemed necessary, or until such time as it may be terminated by twelve months' notice in writing on either side.

3. *Diseases of Bananas.*—In Queensland, investigations are being carried out on two diseases of bananas, viz., "bunchy-top" and "squirter." The major part of the investigations on "bunchy-top." a disease which has practically wiped out the banana plantations in certain areas, has been completed, its cause and the means by which it is spread have been discovered, and recommendations for control have been made to the State authorities. The New South Wales and Queensland Departments of Agriculture are contributors towards the cost of the work, which is under the supervision of Professor E. J. Goddard, Professor of Biology, University of Queensland. The Council has published a Bulletin by Mr. C. J. P. Magee, B.Agr.Sc., the investigator, giving the results of the work.

Another disease of bananas, of unknown cause, usually developing rapidly during the final stages of ripening, while the fruit is still in the custody of the selling agents, has for about four years seriously affected bananas from Queensland. No signs of disease may be visible when the case of bananas arrives from Queensland, but the condition which has been observed in

Melbourne, Adelaide, and Perth develops during the sweating or ripening process, and when the bananas are sufficiently ripe for retail distribution, the diseased condition has developed to such an extent as to render the banana unsaleable. Owing to the readiness with which the decomposed material can be squeezed out from the end of the banana, the disease has been named " squirter." The investigations so far carried out indicate that the disease is due to certain conditions of storage and transport, and that it is related to similar troubles which arise in other fruit such as " brown-heart " in apples. The investigations are also under the supervision of Professor E. J. Goddard, and the Queensland Department of Agriculture is contributing towards their cost.

4. *Tobacco Investigations.*—The Council is co-operating with the Development and Migration Commission and the British-Australasian Tobacco Company, in a comprehensive investigation with a view to ascertaining whether tobacco can be grown in Australia equal in quality to that now grown in North America. The investigation will cover the whole question of the improvement in quality, and the economic production of various types and grades of tobacco, and will include problems of the soil, plant growth, climatic conditions, and economics. Arrangements for proceeding with the work were made at the first meeting of the Standing Committee on Agriculture last May, and are now being carried into effect.

By arrangement with the New South Wales Department of Agriculture, Dr. G. P. Darnell-Smith, Director of the Sydney Botanical Gardens, and Chief Biologist of the Department, is now visiting the United States of America for the purpose of inquiring into the whole position of tobacco cultivation in that country, and of furnishing a report regarding the lines on which experimental work should be developed in Australia. A chemical examination of the differences between Australian and Virginian leaf will be carried out under the control of Professor J. Kenner, F.R.S., Department of Organic Chemistry, Sydney University.

The terms of the co-operative agreement under which the investigations are being conducted are as follows :—

(i) The British Australasian Tobacco Company has agreed to provide over the first period of three years the sum of £20,000 on the condition that a sum of £10,000 is found by the Commonwealth and State Governments for the purpose for carrying out the investigations. If, at the expiration of the three-year period, developments are sufficiently encouraging to warrant further effort, the Company will provide a further sum of £30,000 on the condition that the Commonwealth and State Governments provide a similar sum to be expended over a second period, perhaps of five years.

(ii) The Commonwealth has agreed to subscribe £5,000, and each of the five mainland States £1,000 each for the initial three years.

(iii) An Executive Committee to be appointed, and to be responsible for the policy and general direction of the investigations, and this Committee to consist of one representative each of the Development and Migration Commission, and of the Council for Scientific and Industrial Research, and of a third member to be appointed by the two former representatives. The third representative to be paid such remuneration as may be determined by the Development and Migration Commission and the Council.

(iv) An Advisory Committee representative of the Department of Agriculture of the various contributing States to be appointed, and the investigations to cover the whole question of the improvement in quality and the economic production of tobacco of various types and grades in different parts of Australia.

Applications for appointment to the position of Director of the investigations are being invited in Australia and abroad.

5. *Diseases of Peas and Hops.*—Investigations are being carried out on diseases of peas and hops, which cause great damage in Tasmania. As a result of the work already done, it has already been possible to give definite advice to growers. Further work of a fundamental nature is in progress at Melbourne University by Dr. Ethel MacLennan.

6. *Mycological Problems.*—Dr. B. T. Dickson, formerly Professor of Plant Pathology, McGill University, Canada, has been appointed to take charge of the investigations which the Council proposes to initiate on fungous diseases of plants. These diseases include rusts and smuts of cereals, various soil infesting fungi, such as take-all and foot-rot, and many other plant diseases, and are therefore of immense economic importance to Australia. On his arrival in Australia, Dr. Dickson will get into touch with mycologists in the State Departments of Agriculture and the Universities and will set about the organization and investigation of the many problems requiring attention.

7. *Economic Botany.*—The Council also has under consideration plans for creating a special section to deal with problems in economic botany. Investigations under this head would include work on problems of great economic importance to Australia, such, for example, as :—

(i) Pastoral Problems.—Research on the improvement of pastures, comprising (*a*) natural pastures of low rainfall areas ; and (*b*) pastures capable of improvement by top-dressing, sowing, or other means in higher rainfall areas.

(ii) Genetics.—The breeding of plants giving higher yields and resistant to drought and disease, the production of new varieties, and the reduction of variability and undesirable characters.

(iii) Systematic Botany.—Systematic botany is of fundamental importance to any plant research. In conducting an investigation, it is essential to know accurately the names of the plants. The discrimination is often a matter of great difficulty, e.g., between species of grasses, clovers, acacias, and eucalypts. The adequate investigation of plant problems by the Council will ultimately necessitate the establishment of a National Herbarium.

(iv) Root-stocks, &c., for Fruit Trees.—The selection and development of high-yielding and otherwise desirable stocks and varieties, the elimination of poor trees, and improvement in the standard of performance and the application of the results of this work to the horticulturist are of obvious importance. By such methods the fruit-grower could obtain trees most suitable to his conditions and purpose, and, by the exclusion of unprofitable trees, could be assured of a much higher standard of attainment. While a great deal of very valuable work on problems of the nature indicated above is already being carried out by the State Agricultural Departments, the men responsible for this work are often hampered by routine duties, or through having a number of different problems allocated to them. There is need not only for co-ordination of effort, but also for concerted effort being made to attack in a systematic way many of the fundamental problems concerned.

X.—INVESTIGATIONS ON IRRIGATION SETTLEMENT PROBLEMS.

1. *Scientific Problems Affecting Murray River Settlements.*—The Council has been impressed with the importance of investigating the many problems which affect fruit-growers in the Murray River settlements, extending from the Murrumbidgee Irrigation Area in the east to Renmark and other places in the west. It has approached the whole matter from a geographical standpoint, without reference to State boundaries, and has now completed plans for steady developments in several centres.

2. *Citricultural Problems.*—The main investigations into citriculture and its problems are centred at Griffith, in the Murrumbidgee Irrigation Area, New South Wales. A Research Station was established there some years ago, and is now owned and financed jointly by the Council and the Water Conservation and Irrigation Commission of New South Wales. The latter body is contributing £1,500 per annum towards the expenses of the Station, and is supplying all water free of cost. The present area of the Station is about 60 acres, but reservations of 200 acres for research into rice-growing, and of about 20 acres for investigation into deciduous fruit-tree problems are under consideration. Investigations are being carried out on cultural and manuring problems, bud selection, and citrus stock. As the first trees were planted out only in 1924, it is too soon to expect any definite results. It is inevitable that some years must elapse before any very definite conclusions can be reached. Great interest is being taken in the investigations by the growers in the irrigation area, and particularly in the tile drainage experiments, from which it already appears that " salt areas " can be eliminated by proper methods of irrigation and drainage. Investigations of this nature are of special importance in connexion with the Government's marketing policy, since it is essential for Australia to be able to place the highest grade standard fruit on foreign markets if it is to compete successfully with other countries.

In order to secure close co-operation between the Council and the fruit-growers, and in order to maintain local interest in the investigations, an Advisory Committee consisting of the following members has been appointed :—

Mr. F. K. Watson, M.A., B.Sc., A.M.Inst.C.E. (Chairman), representing the Commonwealth Citrus Research Station, Griffith, and the New South Wales Water Conservation and Irrigation Commission.

Mr. K. C. Williams, representing the Murrumbidgee Irrigation Areas Research Bureau, Griffith.

Mr. J. S. Vagg, representing the Griffith Producers' Co-operative Company, Fruit Section.

Mr. A. J. Kubank, representing the Murrumbidgee Irrigation Rice-growers' Co-operative Society, Leeton.

Mr. P. H. Rutledge, representing the Yenda Producers' Co-operative Society Limited.

Mr. E. S. West, M.Sc., representing the Commonwealth Citrus Research Station, Griffith (officer in charge of the station).

Mr. A. V. Lyon, M.Agr.Sc., the Commonwealth Research Station, Murray Irrigation Areas (Merbein).

The principal terms of the co-operative agreement under which these investigations are being conducted are as follows :—

(i) The Research Station at Griffith is under the joint ownership of the Council and the New South Wales water Conservation and Irrigation Commission.

(ii) The Council assumes control of the investigations and management of the Station as from the 1st March, 1927, but acts in close consultation with the Water Conservation Commission through Mr. F. K. Watson, appointed as a part-time officer of the Council, under the title of Liaison Officer. It also assumes responsibility for all funds required for the purposes of the Station.

(iii) The Water Conservation and Irrigation Commission undertakes :—(*a*) To pay £1,500 per annum towards general expenses of the Station ; (*b*) to supply water free of cost ; and (*c*) to ear-mark possible desirable areas of land for probable work on deciduous fruit and rice respectively, and to hold them until they can be devoted to research purposes.

For the purposes of assuring co-ordination of effort between the work of the Council and that of the New South Wales Department of Agriculture on citricultural problems, and of avoiding undesirable overlapping, the following Committee has been appointed :—

Mr. F. K. Watson and Mr. E. S. West representing the Council.

Mr. H. Wenholz, Director of Plant Breeding, and Mr. W. J. Allen (Fruit Expert), representing the New South Wales Department of Agriculture.

3. *Cultivation of Rice.*—The progress of rice-growing in the Murrumbidgee areas is very striking. This year 5,000 acres are under crop, and where farmers have paid careful attention to the advice given them the yields have been very satisfactory. The rice consumption in Australia is limited, and probably 20,000 acres will suffice to produce it. There appears, however, to be an enormous market available in Japan, which at present imports large quantities from California. The development of this industry will undoubtedly bring all sorts of problems to the grower, and the Council for Scientific and Industrial Research and the Irrigation Commission are taking steps so as to be ready with a research organization to tackle such problems before they reach serious magnitude.

In order to reach a definite decision as to the desirable division of work on problems relating to the cultivation of rice, and in order to secure co-ordination of effort in the work to be undertaken by the Council, on the one hand, and the New South Wales Department of Agriculture, on the other, the following Committee has been appointed :—

Mr. F. K. Watson and Mr. E. S. West representing the Council. (Mr. Watson also representing the New South Wales Water Conservation and Irrigation Commission.)

Mr. A. H. E. MacDonald (or his deputy), Director, New South Wales Department of Agriculture, representing the Department.

A report outlining proposals for the investigation of rice problems is being prepared for the Council by Messrs. Watson and West.

4. *Viticultural Problems.*—For work in viticulture, the Council has taken complete control of the Research Station at Merbein, near Mildura, which was formerly under the control of the Mildura Vineyards Protection Board, but which is now wholly financed by the Commonwealth. The area of the Station is 86 acres, most of it being irrigable. This land was provided by the Victorian State Rivers and Water Supply Commission, which is closely associated with the work. Investigations into manurial and processing problems are being carried out, and already considerable success has been achieved. It has been estimated that the introduction of the "cold-dip" process for the drying of sultanas, which was introduced largely as the result of work at the Merbein Station, represented a gain in quality of product which was worth about £30,000 to the industry during last season alone.

For the same purposes as in the case of the citricultural investigations at Griffith, an Advisory Committee consisting of the following members has been appointed in connexion with the work at the Merbein Station :—

Mr. D. Gordon (Chairman), representing the Mildura Vineyards Protection Board.

Mr. A. Lever, representing the Mildura Vineyards Protection Board.

Mr. S. Thompson, representing the Victorian State Rivers and Water Supply Commission.

Mr. D. C. Winterbottom, representing the Mildura Packers' Association.

Mr. F. K. Watson, M.A., B.Sc., A.M.Inst.C.E., representing the Commonwealth Citrus Research Station, Griffith, and the New South Wales Water Conservation and Irrigation Commission.

Mr. A. V. Lyon, M.Agr.Sc., representing the Commonwealth Research Station, Murray Irrigation Areas, Merbein (officer in charge of the Station).

The principal features of the co-operative agreement under which the work of the Merbein Station is now being undertaken are :—

(i) The Council assumes control of the work and the management of the Station as from the 1st March, 1927, and will find all necessary funds for the purposes of the Station from that date.

(ii) The Victorian State Rivers and Water Supply Commission undertakes to grant to the Council a lease of the land at Merbein for fifteen years, with the option of renewal.

5. *Investigation of the Salt Problem.*—Arrangements have been made for an intensive investigation of the salting problem, the Research Station at Merbein being admirably suited for that purpose. It is well known that very serious trouble has been experienced in certain irrigation areas, both in Australia and in other countries, through soluble salts being dissolved in the irrigation water as it passes down through the soil, and then coming up with the water in its later capillary rise to the surface. An area at Merbein of 26 acres of land still carrying virgin vegetation has been set aside for this investigation. The Victorian State Rivers and Water Supply Commission has carried out a close contour survey of the area. Though it will necessarily be several years before full and accurate knowledge of the behaviour of the salts will be available from these investigations, it is the opinion of all concerned that the information is of the utmost importance, and that it will be of immense value in the planning of future irrigation settlements.

6. *Soil Problems.*—Probably the most fundamental section of the work now in hand is the soil survey, which is under the direction of Professor J. A. Prescott, of the Waite Institute, University of Adelaide. The analytical work will be carried out in Adelaide and at Griffith by uniform methods. Attempts will be made to correlate the physical, chemical, and bacteriological constitution of the soils, and the original natural vegetation carried by them, with the results obtained by growers in their vineyards, citrus groves, and orchards. Though it will be some time before results will be yielded by this work, the value of it in years to come, as fresh lands are made available for settlement, should be very great indeed.

The terms of the co-operative agreement under which this work is being conducted, and which came into force on the 1st May, 1927, are as follows :—

(i) The Council undertakes (*a*) to equip the laboratory at the Commonwealth Research Station, Griffith, for soil investigations, and to carry out there all investigations necessary in the Murrumbidgee area ; (*b*) to make available the laboratory at the Commonwealth Research Station, Merbein, for use as a field laboratory in connexion with investigations in the Mildura and surrounding districts, and to provide any additional equipment necessary ; (*c*) to provide the necessary funds for a survey field officer and assistant chemist at the Waite Institute, and an assistant at the Griffith Station ; (*d*) to provide £1,500 towards the erection of a soil laboratory at the Waite Institute ; and (*e*) to provide funds for expenditure at the Waite Institute for incidentals such as gas, electric power, and heat, chemicals, replacements of glassware, &c., and contingencies.

(ii) The University of Adelaide undertakes to direct the investigations from the Waite Institute, to carry on there the more fundamental work as distinguished from the systematic work, and to lay down rules so as to standardize practice. This is to be done at the Waite Institute as part of the Institute's normal functions, and independently of any financial assistance provided by the Council under this arrangement.

The Council has under consideration the whole question of soil survey work in the Commonwealth, and as an initial step has appointed Professor J. A. Prescott as its adviser on Soil Problems. At present there is no soil survey in Australia on modern lines. In the several State Departments of Agriculture valuable work is done on soil analyses by the analytical chemists, but this work is necessarily often without direct contact with the field problems which are being investigated, since there are fundamental problems in soil science concerning which no Australian data are yet available, e.g., data regarding the physical condition of our soils and their biological conditions in the virgin and cultivated state. At the Waite Agricultural Research Institute, South Australia, Professor Prescott and his colleagues have adopted modern methods of soil examination, and are in close contact with agricultural practice. Arrangements have been made by the Council for Professor Prescott to furnish a report on the whole matter of soil survey work, which should obviously be carried out on uniform and comparable lines throughout the Commonwealth.

7. *Proposed New Irrigation Research Station.*—Authoritative advice obtained by the Council has disclosed the fact that, for various reasons, the Research Station at Merbein is not suitable for the purpose of carrying out scientific investigations on irrigation problems generally in accordance with modern scientific statistical and other requirements. Consideration has, therefore, been given to the question of establishing a new station in more typical good quality soil, and a recommendation made by the Merbein Advisory Committee that the site of the proposed station should be at Coomealla, in New South Wales, adjacent to Mildura, and about twelve miles distant therefrom, has been provisionally approved. This proposal is cordially supported by the New South Wales Water Conservation and Irrigation Commission, which will advise the Council on all questions relating to the irrigation of the proposed area. It has been decided that if the new station is established, it shall be developed as a Research Station for the investigation of irrigation problems generally, and not merely for the investigation of viticultural problems. The Council has opened up negotiations with the British Empire Marketing Board, with a view to obtaining the co-operation and financial support of the Board in establishing the new Station as an Imperial Research Station for the investigation of irrigation problems.

XI.—INVESTIGATIONS ON ENTOMOLOGICAL PROBLEMS.

1. *General.*—In view of the great importance of investigating the various insect pests which levy so large a toll on our agricultural, horticultural, and pastoral industries, the Council is preparing plans for the creation of a special Entomological Section. At present the principal problems under investigation are the grass-grub, the buffalo-fly pest, and dried fruit pests.

2. *Underground Grass-grub—Tasmania.*—A serious state of affairs has arisen in Tasmania through the depredations to pasture lands caused by a species of underground grass grub. As a result of the damage done to the roots of the grass, pastures are rapidly eaten out in the early spring, and very little feed is left for the summer months. In many localities the pest has entirely upset the ordinary farming rotation systems. A considerable amount of work has already been done by Mr. G. F. Hill, an officer of the Council, in ascertaining the life-history of the grub, and on methods for its control. A series of field experiments, based on a knowledge of its habits, have been carried out with a power-spray outfit during the winter and early spring. It is anticipated that the results of these experiments will indicate satisfactory methods of controlling this pest on grazing land of high productivity. Control by natural enemies appears to be the only economically possible method of combating grass-eating insects of the less productive hilly and partly cleared areas, and investigations with this object in view have been carried out in Victoria and South Australia, where allied species are known to occur in less destructive numbers. Progress has been made also in the study of the habits and methods of control of white grubs and cutworms, both of which cause extensive damage in certain localities.

3. *The Buffalo-fly Pest.*—The buffalo-fly is one of the most serious menaces to the cattle industry in the Northern Territory, and in the northern parts of Western Australia. The injury to the cattle is not due to the transmission of any disease, as in the case of cattle-tick, which causes red-water, but is caused by the incessant annoyance, irritation, and loss of blood owing to the flies clustering around the base of the horns and other parts of the bodies, and to abrasions caused by the animals in their efforts to dislodge the flies. It is believed that the pest was introduced into Australia from Timor, from which country the cattle-tick was also introduced. The cattle-tick has already spread through Queensland, and has only been prevented from further spread southwards by the action of the New South Wales Government in maintaining a buffer area on the State border. It has already caused enormous financial loss to the Australian cattle industry, and if the buffalo-fly extends similarly, it is believed by many authorities that it will prove an even worse pest than the cattle-tick.

In co-operation with the Western Australian Department of Agriculture, the Council arranged for an investigator, Mr. D. Murnane, B.V.Sc., to make observations as to the spread and prevalence of the pest, initially working from Wyndham, Western Australia, as a centre, and then proceeding via Darwin, through the Gulf Coast country, to Queensland.

Following on the report which the Council obtained from Mr. Murnane, inquiries were sent to entomological authorities in the Philippines, the Dutch East Indies, and the Hawaiian Isles asking whether they could arrange for investigations to be carried out on behalf of the Council with a view to ascertaining whether there are any natural enemies which destroy the buffalo-fly in any stage of its life history in the respective countries. The replies which were received in response to these inquiries have been submitted for the consideration of a Committee, consisting of Dr. J. A. Gilruth (Chairman), Dr. Georgina Sweet, Professor H. A. Woodruff, and Mr. G. F. Hill.

In accordance with the recommendations of that Committee, advice is now being sought from Dr. G. A. K. Marshall, Director of the Imperial Bureau of Entomology, as to the practicability of securing a consignment of *Hydrotaea dentipes*, which in its larval stage lives on the larvae of the stable fly and the house fly, and which may therefore reasonably be expected to parasitize also the larvae of the buffalo-fly. Dr. Marshall is also being asked for advice as to the prospects of establishing *H. dentipes* in Australia and, in the event of it being successfully established, as to the possibility of it becoming a pest of economic animals or plants.

The Council has also decided to avail itself of an offer made by Dr. B. Maaesmach, Director of the Veterinary Institute, Buitenzorg, Java, to arrange for a study to be made of the natural enemies of species of buffalo-fly in that country, under the control of Dr. O. Nieschulz. Information is also being sought from appropriate authorities in the British and foreign Colonies and Protectorates in Africa and from the Imperial Entomologist, India, as to the economic status of species of buffalo-fly in their respective countries and as to the prospects of securing natural enemies suitable for transportation to Australia.

From the information already obtained by the Council it is evident that the buffalo-fly is a very serious pest in certain parts of Northern Australia, that it has spread over considerable areas during recent years, and that, with the opening up of additional railway lines and other means of transport, there is a grave danger of the fly spreading further, especially in the north-eastern parts of the continent. Observers in Australia have expressed the view that if the fly reaches Queensland it may well prove to be an even more serious menace to the cattle industry than the cattle-tick pest has proved to be.

The Council, therefore, views the position with very considerable concern, and is anxious to take all steps practicable to carry out scientific investigations with a view to the control of the buffalo-fly and preventing its further spread. It appears, however, that control by natural enemies is the only method which is likely to lead to satisfactory results.

4. *Insect Pests of Dried Fruit.*—The problem of insect pests which infest our dried fruits, and which have threatened great damage to the industry, has been investigated by the Council in co-operation with the Empire Marketing Board. Dr. J. G. Myers, of the Imperial Bureau of Entomology, has carried out investigation in Victoria and South Australia, and to a minor extent in Western Australia, and arrangements were made for him to obtain definite information regarding shipboard conditions by inspecting a consignment of 500 tons of fruit sent by the ship on which he returned to England. From the report which Dr. Myers has furnished, it appears that there is every prospect of attaining almost complete control of the pest without the necessity of any elaborate methods of fumigation. As a result of action taken by the Council's officer-in-charge of the viticultural work at Merbein, and by officers of the Department of Markets, great improvements have already been effected in the conditions in the packing sheds. Concrete floors, care in the disposal of waste fruit, and general vigilance have resulted in a marked diminution in the degree of infestation. In his report Dr. Myers thoroughly emphasizes the fact that infestation occurs after the fruit is packed. He therefore advocates that all possible measures be taken to ensure the utilization of insect-proof packing. He considers that sterilization before packing may not be necessary if hygienic conditions of packing and storage are rigidly enforced and if an efficient type of insect-proof container can be evolved. Four main types of such containers will be used experimentally for Australian dried fruit during the forthcoming season.

5. *Lucerne Flea in South Australia.*—The Council has carried out certain preliminary investigations on the lucerne-flea pest (*Smynthurus viridis*), which has become a serious menace to the successful cultivation of lucerne, cereals, clovers, and other pasture plants in South Australia. Mr. G. F. Hill, the Council's Entomologist, has furnished a report to the effect that the insect has become too widely distributed to be controlled successfully by artificial means, and that the

only satisfactory solution of the problem appears to be the discovery and introduction from abroad of effective natural enemies. In the lower Murray River irrigation areas, however, where only a relatively small proportion of the area under lucerne and pastures has become infected, it was considered desirable to adopt artificial methods of an emergency nature in order to confine the outbreak to its existing limits, if possible, and recommendations to that effect were made to the South Australian authorities.

The Council has also received a preliminary report on this pest from one of its research students, Mr. F. G. Holdaway, M.Sc., who is now undergoing a course of training in Economic Entomology in the United States of America, but who carried out investigations on the lucerne-flea before he left South Australia.

6. *Ragwort—Biological Control.*—During the progress of the investigations on the Underground Grass-grub (see paragraph 2 above) the Council's Entomologist (Mr. G. F. Hill) discovered three species of insects which may prove to be of great value in controlling ragwort, a poisonous weed which has become well established in various parts of the Commonwealth and New Zealand, and is causing considerable concern amongst stock-owners. The insects referred to are the larvae of a small fly which tunnel in the leaves, and the larvae of two species of moths which feed on the leaf stems, young shoots, and woody parts of the plant. It has been shown experimentally that three or four caterpillars are capable of destroying young plants about 6 inches high in the course of not more than one week. In their natural state these beneficial insects are held in check by parasites, but it is thought to be highly probable that once established in ragwort-infested areas in which the parasites do not exist, they may play an important part in bringing the weed under control.

Preliminary tests have given very encouraging results, but exhaustive feeding experiments will have to be carried out to determine the suitability of the insects for distribution in Australia and in other countries.

7. *St. John's Wort—Biological Control.*—Inquiries have been made by the Council regarding the practicability of controlling and eradicating St. John's Wort by the introduction into Australia of insect enemies which destroy the plant in other countries. A report on the matter has been furnished to the Council by Dr. R. J. Tillyard, F.R.S., Assistant Director of the Cawthorn Institute, New Zealand. Dr. Tillyard was sent to Europe last year to make inquiries for the New Zealand Government on the possibility of controlling certain weed pests, and the Council took the opportunity of commissioning him to report also on insect enemies of St. John's Wort.

The most common species of insect which feeds on St. John's Wort is a beetle (*Chrysomela hyperici*), and Dr. Tillyard arranged for tests to be carried out by Miss Patterson, B.Sc., of Cambridge University, to ascertain whether this insect will attack any plants other than St. John's Wort. Tests have already been carried out on a large number of plants, and so far they have shown that the beetle will not feed on any other plant. Miss Patterson is continuing her investigations, and will report at the end of her work as to whether these insects will, at any stage in their life-history, attack any other plant.

Dr. Tillyard has also reported on a number of other insects, including certain gall-forming species, which attack St. John's Wort. One of these destroys the flowering shoots of the plants, while another stops the growth of the new shoots while still underground. He recommends that arrangements be made for a complete study in England of the insects attacking St. John's Wort, that exhaustive tests be carried out to ascertain whether they will feed on any other plant, and that those species which give negative results should be brought to Australia and reared there in closed insectaries, and should be subjected to further food tests as regards Australian plants in the same way as tests have been carried out on insects attacking prickly-pear.

Dr. Tillyard's recommendations are being considered by the Council in connexion with its general plans for the development of entomological investigations.

8. *Sheep Blow-fly Pest.*—The Council is co-operating with the New South Wales Department of Agriculture in investigations on the sheep blow-fly problem, and has made the services of two officers available, one an entomologist, and the other a veterinary officer, to assist in the work which that Department is conducting at its experimental station at Nyngan.

XII.—INVESTIGATIONS ON ANIMAL PESTS AND DISEASES.

1. *Investigations at Existing Veterinary Research Institutions.*—The Council was impressed with the importance of undertaking further work in Australia on the diseases and pests of animals of economic value. Comprehensive figures showing the total annual loss entailed through these pests and diseases are not available, but there is no doubt that it runs into some millions of pounds sterling. It is estimated that, in a bad year, the loss from the sheep blow-fly pest alone is as much as £4,000,000.

Investigations on many of the most serious pests and diseases are already being carried out at one or other of the Veterinary Research Institutes in the Commonwealth. Further progress in their control and eradication can generally be made only as a result of fundamental scientific investigation as to the nature of the diseases, their causes, and the agencies by which they are spread. The Council, therefore, convened a Conference of leading veterinary pathologists in order to obtain advice as to what action could best be taken in the matter. As a result it was decided to offer assistance to the Veterinary Research Institutes by employing competent workers, and seconding them for duty at these Institutes in order to carry out investigations on a number of problems which cause great loss to our pastoral industries. This has been done, and various investigations are now in progress. For example, work is being carried out at the Glenfield Animal Research Institute, New South Wales, on (*a*) paralysis in pigs, a disease which occurs especially in young pigs being topped off for the bacon factory, and which is a matter of great concern to the dairying industry ; (*b*) toxaemic plethora, which causes high mortality in the best lambs, and of which the cause is quite unknown ; and (*c*) sterility in cows, which is also of very serious concern to dairy farmers. At the Sydney University Veterinary Department work is being carried out on braxy disease in sheep, a disease which occurs under different names in several of the States, and on caseous lymphadenitis in sheep, which is prevalent in Australia, and which is becoming of serious importance in connexion with the export of frozen sheep. Investigations on parasitological problems are also being carried out by Mr. I. Clunies Ross, B.V.Sc., who is studying the infestation of sheep by the liver-fluke and by stomach worms. At the Melbourne University Veterinary Research Institute investigations are in progress on bovine pleuro-pneumonia and tuberculosis in cattle. At the Pathological Laboratory attached to the Adelaide Hospital investigations are being carried out under the direction of Dr. Lionel Ball on (*a*) haematuria in cattle, which disease is prevalent in the Mount Gambier district of South Australia, and in adjacent parts of Victoria ; and (*b*) anti-parturient paralysis in ewes.

With a view to the development of its investigations on animal problems, the Council is in communication with the University of Melbourne regarding certain suggestions which have been made that the Council should take over the Melbourne Veterinary Research Institute, Parkville, as a Research Station, in the event of the University authorities deciding that the Institute shall not be used for teaching purposes.

2. *Kimberley Horse Disease.*—Kimberley horse disease is a problem of major importance which the Council is investigating in co-operation with the Western Australian Department of Agriculture. This disease interferes seriously with settlement in the northern parts of Western Australia, and appears to be identical with " Walk-about disease " in the Northern Territory and " Birdsville disease " in Queensland. It is stated that in the West Kimberley district of Western Australia 30 per cent. of the horses die from the disease every year. A veterinary officer (Mr. D. Murnane, B.V.SC.) and a botanist (Professor A. J. Ewart, F.R.S.) have been sent to the Kimberley district to carry out a scheme of work which had been drawn up with a view to ascertaining the precise nature of the disease. Whether it is a parasitic disease or not is still obscure. One theory for which a good deal of evidence had been put forward is that it is due to a certain poisonous plant which is eaten by the horses, and which is particularly virulent at the stage of early growth after rains. Though the Council's advisers are sceptical about the adequacy of the evidence in support of this theory, and consider that other possibilities have been quite insufficiently tested, it seems desirable to make a thorough study of such edible plants as may be exerting a poisonous effect. It is hoped that the results of the work on the pathological and botanical sides will clear up the problem of the nature of the disease, and so open the way to the devising of means for its prevention, or, at any rate, for its treatment. Certain evidence has already been obtained from the tests indicating that the disease may be due to a species of *Atalaya*, a shrub which is fairly widely distributed and which grows to a height of from 5 to 6 feet. Confirmatory tests are being carried out, and no definite statement as to whether *Atalaya* is responsible for the disease can be made until these tests are completed.

3. *Poison Plants.*—In certain parts of the Commonwealth poisonous plants are sometimes credited with causing heavy losses of stock. It is difficult to estimate the extent of the damage done, since there is often wide diversity of opinion regarding the precise causes of sudden mortality in flocks and herds. The Council has arranged, in co-operation with the New South Wales Department of Agriculture and the University of Sydney, for a thorough inquiry, which will probably extend over several years, into the principal poison plants of the Commonwealth. There are three sections to the work. On the organic chemical side the main part of the work will be carried out under the control of Professor J. Kenner at the University of Sydney by chemists on the staff of the Council. There will also be collaboration on this part of the work with the chemistry section of the Sydney Technological Museum. On the veterinary side, the experimental

work will be conducted at the New South Wales Government's Veterinary Research Institute at Glenfield by Dr. Seddon, while the pharmacological section will be carried out in the Departments of Professor H. G. Chapman and Mr. H. Finnemore, University of Sydney.

From a combination of these three lines of investigation, it should be possible to obtain a great deal of evidence upon which to base preventive or remedial measures of value to pastoralists and others. It is possible, too, that products will be isolated which will be of service in pharmacology, since little has been done yet in the direction of determining the medicinal values of essential principles contained in Australian plants. In order to advise it as to the manner in which the investigation is to be conducted, the Council has appointed a Committee consisting of Professor J. Kenner, F.R.S. (Chairman), Professor H. G. Chapman, Dr. H. R. Seddon, Mr. Max Henry, Dr. G. P. Darnell-Smith, Mr. H. Finnemore, and Professor T. G. B. Osborn.

The principal features of the co-operative agreement under which the investigations are being conducted are :—

(i) The Council agrees (*a*) to appoint a Committee to advise it regarding the manner in which the investigation is to be conducted, such Committee, to report direct to the Council, and through it to the University and the State Department ; and (*b*) to provide the funds necessary for the investigation, subject to Ministerial approval.

(ii) The University of Sydney agrees (*a*) that Professor Kenner, Professor Chapman and Mr. H. Finnemore may act on the controlling Committee, and that the ordinary facilities of University Departments will be at their disposal in the work which they respectively undertake ; and (*b*) to permit officers of the Council engaged on the investigation to work in and to use all the ordinary facilities of the Departments of Chemistry and Pharmacology, it being understood that while within University boundaries such officers are subject to the discipline of the University.

(iii) The Department of Agriculture of New South Wales agrees (*a*) that Dr. Seddon, Dr. Darnell-Smith, and Mr. Max Henry may act on the controlling Committee, and that Dr. Seddon may supervise that part of the work which will be conducted at Glenfield ; and (*b*) to make the normal facilities at Glenfield available for the work.

(iv) The officers will be appointed by the Council subject to the approval of the University and the Department of Agriculture.

(v) The co-operative arrangement will be continued with such modifications as may from time to time be deemed necessary, until such time as it may be terminated by general consent, or by twelve months' notice in writing from one of the associated parties.

4. *Dingo Pest.*—Suggestions have been made by pastoralists and others that the Council should carry out investigations on the dissemination of distemper or other diseases amongst dingoes, and that at the same time steps should be taken with a view to the treatment of domestic dogs so as to render them immune to the disease. In many parts of Australia the dingo is a serious pest, and though action has been taken by certain of the State authorities for the construction of dog-proof fences and for the destruction of dingoes under Wild Dog and Vermin Destruction Acts, it does not appear that there is any substantial diminution of the pest.

Inquiries on the matter have been made by the Council from authorities in England, where a Distemper Research Committee has been carrying out investigations for a number of years with the objects of ascertaining the precise nature of the disease, how it is spread, and whether any effective method can be found for rendering dogs immune. Sir Charles Martin, Director of the Lister Institute, London, and Professor Buxton, University of Cambridge, both definitely condemned the suggestion that efforts should be made to spread distemper among dingoes. They considered that it would be almost impossible to start anything in the nature of an epidemic, and that, even if started, it would not secure the desired result. Moreover, the work of the Distemper Research Committee in England had not proceeded far enough to enable any effective action to be taken for the immunization of domestic dogs. The conclusions arrived at in England are fully supported by the work of the veterinary officers in certain of the State Departments.

5. *Flying-fox Pest.*—The Council has had under consideration the question of carrying out investigations on the control and eradication of this pest, which causes serious loss to horticulturists, especially in Queensland and New South Wales. Many obvious methods of destruction have been tried. Shooting is expensive and ineffective. Strychnine poisoning in the orchard is partially successful. Poison gases in the camps of the flying-foxes are not effective,

because it appears to be impossible to give a lethal dose before the animals take wing. Infection with a certain bacillus is said to have cleared Samoa of the pest some years ago, but inquiries made by the Council did not confirm this report, and it is understood that Samoa is still badly infested. A small " flammenwerfer " has been tried, but besides being dangerous and expensive, it is not suitable for general use. These and other methods have been more or less successful in killing flying-foxes, but in every case the scale of possible operations is hopelessly inadequate. The Council is making inquiries with a view to obtaining advice or suggestions for attacking the problem.

XIII.—ANIMAL NUTRITION—INVESTIGATIONS.

1. *General.*—Arrangements have been made by the Council for an extensive and fundamental investigation into problems associated with the nutrition of stock in Australia. The work is being carried out by the Council in co-operation with the University of Adelaide and the Waite Agricultural Research Institute. From many quarters the Council has received evidence of the need for a carefully-planned systematic investigation into such questions as the composition of pastures from the points of view of their protein, mineral, and vitamin contents ; the regeneration of depleted natural pastures ; and the relations between growth of stock, nature of pasture, and geological type of country. At first the applied work will be limited mainly to sheep, considered both as meat and wool producers. In planning this work the Council is looking very far ahead. The work is far from being spectacular, and cannot be expected to show major results for some years, but of the imperative need for such a development in Australia there can be no two opinions.

2. *Fundamental Investigation on Animal Nutrition.*—The investigations have been planned in two main divisions. In the first place, arrangements have been made for a fundamental investigation of the nutrition of animals to be carried out under the control of Professor T. B Robertson, University of Adelaide. The whole of his technique, as well as his trained assistants. has been placed at the disposal of the Council which is erecting a laboratory at Adelaide for the purpose of carrying out the work. At first investigations will have the primary object of ascertaining the exact nature of certain deficiencies in leaf proteins of those fodder plants upon which Australian sheep chiefly depend in times of drought. Afterwards the investigations will be extended to other plants, especially to those which make their appearance after rain in the arid districts, and finally to the pasture plants of the districts which have a more abundant rainfall. Investigations with laboratory animals will also be carried out in order to determine the effect of excess magnesium or potash upon the mineral requirements of the animal in other directions, and the information thus obtained will be of value in enabling pastoralists to correct known excesses of this nature by the use of licks or by the addition of minerals to stock waters.

The main points of the agreement under which the investigations are being conducted, and which came into force on the 1st February, 1927, are as follows :—

(i) The Council undertakes (*a*) to erect a suitable building to be used as laboratories for the purpose of the investigations ; (*b*) to maintain the building to the satisfaction of the University Council so long as it is occupied by the Council ; (*c*) to pay the salaries of officers as specified ; (*d*) to make all officers subject to University regulations relating to conduct while they are engaged in the work within the University boundaries ; and (*e*) to provide the annual expenditure necessary for the purchase of experimental animals, chemicals, apparatus, &c., as specified hereafter.

(ii) The University of Adelaide undertakes (*a*) to provide a site for the laboratory building ; (*b*) to place at the disposal of the officer-in-charge of the laboratories all such general facilities as it places at the disposal of the professional and other officers of its own laboratories ; (*c*) to make available the income of the South Australian Animal Products Research Association Fund, estimated at £500 per annum, for the purpose of the investigations ; (*d*) to grant the Council free of all charge the right of occupancy of the laboratories in perpetuity, provided that if the Council determines to abandon the investigations after a period of fifteen years has elapsed, and has no further use for the laboratories (either for the purposes specified above or for any other purposes approved by the University Council), the University will take full possession of the building. If the Council desires to abandon the use of the laboratory for the purposes of any investigations prior to the expiry of the fifteen years' period, the building may be taken possession of by the University on terms to be mutually arranged.

3. *Investigations on Mineral Deficiences of Pastures.*—The fundamental work referred to in the preceding paragraphs is being linked up with field investigations on sheep at the Waite Institute. At the present time the problem of mineral deficiencies of pastures is exercising the minds of agricultural authorities throughout the Empire. The Empire Marketing Board has made funds available on a contributory basis for carrying out research on this problem in Australia. This offer was originally made to Professor A. E. V. Richardson, Director of the Waite Institute, when he was in England last year. The offer has now been transferred to, and accepted by, the Council. The general object of the work is to determine the role of mineral nutrients on the growth, development, and nutrition of stock. Special attention will at first be devoted to the effect of deficiencies of phosphorus and calcium on pastures typical of the large areas of territory which are notably deficient in these constituents. With Professor J. A. Prescott to advise on soil problems and Professor T. G. B. Osborn on plant problems, and especially on problems of regeneration of fodder grasses and plants which he has been studying for some years on a station at Koonamore, South Australia, an effective organization has been created to accumulate knowledge on these very important problems of nutrition.

The terms of the co-operative agreement under which these investigations are being carried out are as follows :—

(i) The Council undertakes (*a*) to accept an offer of the Empire Marketing Board to provide £3,000 for the capital expenditure and £1,875 annually for a period of five years on a £1 for £1 basis with contributions provided in Australia ; (*b*) to provide a sum of £1,500 for capital expenditure and the balance of the sum of £1,875 per annum for five years (approximately £975 per annum) towards the annual expenditure ; and (*c*) to provide an additional sum of £1,500 for capital expenditure either for an extension of the work on mineral deficiency of pastures or for some new and probably related lines of investigation, should the University of Adelaide make available a similar amount.

(ii) The University of Adelaide undertakes (*a*) to provide a sum of £1,500 for capital expenditure and to allocate the sum of approximately £900 per annum for five years, which sum it is already devoting to similar work as a contribution towards the annual expenditure (the Empire Marketing Board having agreed to regard such expenditure as part of the Australian contribution on a £1 for £1 basis) ; and (*b*) to carry out the work at the Waite Institute under the direction of Dr. A. E. V. Richardson.

4. *Investigations in Queensland.*—During the 1926–27 drought, which existed over large areas of Queensland, sheep and cattle were fed with many different varieties of emergency fodders. Representations were made by various authorities in Queensland, such as the United Graziers' Association and the Longreach Chamber of Commerce, that much valuable information would be obtained if some suitably qualified person were appointed to visit the various districts and collect information that would be available as to the effects of these different fodders, &c. Arrangements were accordingly made by the Council in January, 1927, for an officer (Mr. J. E. Thomas, B.Sc., B.Agr.Sc., B.V.Sc.) to make these inquiries. The work has been carried out and a report on the inquiry is in course of preparation.

XIV.—FOREST PRODUCTS INVESTIGATIONS.

1. *Paper-pulp Investigations.*—Prior to the creation of the Council, very satisfactory results had been obtained from the investigations on paper-pulp initiated by the former Institute of Science and Industry, and carried out by Mr. L. R. Benjamin. An investigation on the pulping of eucalypt woods by the sulphite process was first taken up in 1924, following the successful application of the soda process in a modified form to the pulping of eucalypts. As a result, it appeared that there was every probability of manufacturing sulphite pulp sufficiently cheaply to allow of its use in the manufacture of newsprint, of which over 100,000 tons per annum are imported into Australia. The matter was taken up by certain commercial interests, which carried out a large-scale test in Europe, for which purpose 100 tons of stringybark wood from Tasmania were used. The results obtained in the laboratory with a few pounds of wood were thus repeated on a 100-ton lot, and the agreement in results was satisfactory. Financial interests have now decided to expend up to £50,000 to test the practicability of manufacturing newsprint on a 1 ton per day plant, and it is stated that if the results are satisfactory the establishment of the newsprint and sulphite cellulose industry, involving the expenditure of from £1,500,000 to £2,000,000 in the course of the next five or six years, is assured.

The Council has recently concentrated its work in this sphere on the production of a satisfactory mechanical pulp for use, together with chemical pulp, in the production of newsprint. Definite conclusions have now been reached as a result of this work, and it is believed that they will assist materially in the establishment of the newsprint and sulphite cellulose industries. Four outstanding factors have been established on the laboratory scale. The first is that approximately 30 per cent. of groundwood or mechanical pulp from certain immature eucalypts can be used with sulphite pulp from similar woods. Secondly, adjustment of mechanical conditions in sulphite cooking have resulted in considerable reduction of cooking time (from ten to six hours—a saving of four hours), with a pronounced increase in yield and improvement in quality of pulp for newsprint purposes. The third important point is that bleaching of sulphite pulp is unnecessary for newsprint, and the fourth is that the combined result of the new data which have been obtained indicates a reduction of from £2 to £3 per ton in the cost of production of newsprint.

The results of the work referred to above have been published by the Council in Bulletin No. 31, entitled " Newsprint : Preliminary Experiments on the Grinding of Immature Eucalypts for Mechanical Pulp and Possibilities of Manufacturing Newsprint in Australia."

Very promising results have also been obtained from the Council's investigations on *Pinus insignis*, an imported pine planted largely throughout Australia. It has a considerable advantage over other woods in its remarkable rate of growth. The results show that the pulp from *Pinus insignis* is eminently suitable for use in the manufacture of the strong brown wrapping paper used for paper bags, &c., commonly known as kraft paper. Large quantities of *Pinus insignis* are available, especially in the south-eastern parts of South Australia, and there is every reason to believe that all the kraft pulp required in Australia can be produced in this country in the next ten or twelve years, and that the quality will be equal to that of the paper now imported. The Council, in co-operation with the Development and Migration Commission, has arranged for semi-large scale tests to be carried out, in the belief that they will lead to commercial exploitation on a large scale. It is expected that the necessary plant will have been erected and that the tests will commence early in October, 1927, at the Sydney mill of the Australian Paper Manufacturers Limited.

2. *Artificial Silk.*—During the sulphite pulp investigations, the purity of the various products was carefully studied, and results were obtained indicating the practicability of producing a very high grade cellulose suitable for the manufacture of artificial silk. This aspect of the sulphite pulp investigation is being followed up actively by the Council, and arrangements are being made to send samples of the pulp to England to try out its suitability for the manufacture of artificial silk.

3. *Tannin Investigations.*—It is common knowledge that the position of Australia with respect to materials for tanning is not satisfactory, and that although this is the home of the wattle, large quantities of bark are now imported from South Africa. A comprehensive survey of Australian tannin resources has now been completed by Mr. D. Coghill, an officer of the Council. Broadly speaking, the results show that, in addition to the well-known wattles, Australia is comparatively well off for tan-stuffs. This is particularly the case in Western Australia. Most of the tannins are found to occur in various members of the genus *Eucalyptus*. The tropical areas of Australia are also rich in high tannin content mangroves. The results so far obtained indicate that abundant supplies of various classes of tanning materials are available, and that some of these could most likely be worked up to form suitable tannin extracts. Now that the necessary preliminary work has been completed, the Council is energetically attacking the problem of commercial production of tannins in the form of extracts. A small semi-commercial scale tannin extract plant is being erected in the grounds of the University of Western Australia, and the investigation of the higher grade and more abundantly occurring tanning materials from the point of view of tannin extracts is to be initiated at once. This work is being undertaken by the Council in co-operation with the Western Australian Forestry Department and the University of Western Australia. It is under the general control of a committee consisting of Mr. S. L. Kessell, Conservator of Forests, Western Australia, and Professors Wilsmore and Whitfield, of the University of Western Australia.

The terms of the agreement under which the above investigations are to be conducted are as follows :—

(i) The investigation is to be carried out co-operatively by the Council for Scientific and Industrial Research, the Forests Department of Western Australia, and the University of Western Australia through a Tannin Extract Investigations Committee, one member of which, Professor Wilsmore, shall exercise direct supervision over the investigations.

(ii) The Council agrees with the University (*a*) to erect suitable buildings to be used for housing the plant and as laboratories for the purpose of the investigations ; and (*b*) to pay the salaries of officers and all other expenses connected with the work.

(iii) The University agrees with the Council (*a*) to provide a site for the buildings required for the plant and laboratories ; (*b*) to place at the disposal of the officer-in-charge of the laboratories all such general facilities as it places at the disposal of the professorial and other officers of its own laboratories ; and (*c*) to grant the Council free of all charge the right of occupancy of the buildings for fifteen years.

(iv) The Forests Department of Western Australia agrees with the Council (*a*) to find a sum not exceeding £2,000 for the purpose of completing the necessary plant for semi-commercial extract work, and assisting in the erection thereof ; and (*b*) to deliver tan-bark free to the plant, and to make available the services of an engineer to erect and run the plant.

(v) The Council agrees with the Forests Department of Western Australia (*a*) to make available plant already in the possession of the Council, valued at about £1,600, and to provide a sum of £500 to assist further in the erection of plant and laboratory, and the purchase of laboratory equipment, if the sum of £2,000 to be provided by the Forestry Department does not prove adequate ; (*b*) to provide the services of a chemist as full-time investigator ; and (*c*) to meet maintenance expenditure in the investigations.

4. *Proposed Forest Products Laboratory.*—The Council has received a large number of requests to carry out investigations on various forest products problems and for the establishment of a forest products laboratory in Australia. It was decided to obtain the advice of a highly qualified authority on the whole question, and, at the request of the Commonwealth Government, the Government of India agreed to make available the services of Mr. A. J. Gibson, Conservator of Forests, Bihar and Orissa, to visit Australia for a period of about four months, and to furnish a report and to advise on the whole matter. Mr. Gibson arrived in Australia in August, 1927. After completing his inquiries he will furnish a report to the Council.

XV.—INVESTIGATIONS ON COLD STORAGE PROBLEMS.

1. *General.*—The whole question of undertaking systematic investigations on problems connected with the preservation, storage, and transport of perishable food products has been carefully considered by the Council. The matter is obviously one of great importance in connexion with the export of foodstuffs from Australia and with the problem of finding markets. The Low Temperature Research Station at Cambridge has already carried out a considerable amount of fundamental work in connexion with these problems, and was, in fact, responsible for the solution of the problem of brown-heart in apples, a disease which formerly resulted in a loss to Australia of as much as £250,000 in one year.

2. *Meat Problems.*—As regards meat, probably the most important problem is that relating to the freezing and chilling of beef. Owing to the time taken by the voyage from Australia to England, beef for export has to be frozen, and when thawed frozen beef exudes an objectionable drip. The result is that the price obtained for Australian beef on the London market generally compares unfavourably with that of chilled Argentine beef. Investigations on this matter have been carried out by a committee of the Australian National Research Council, subsidized by a grant from the funds of the Council for Scientific and Industrial Research, and helped also by various facilities made available by the Victorian Department of Agriculture and by the Melbourne University. Results obtained on a small scale indicate that if beef can be frozen sufficiently rapidly its properties on thawing are very considerably improved as compared with beef frozen in the usual way. These investigations are being continued, and are being conducted specially with a view to studying the effect of the age of the beef, the variety of the beef, and other conditions of the beast prior to slaughter.

3. *Fruit Problems.*—As regards fruit, though the mechanical production of cold has now reached a high state of efficiency, little accurate information is yet available concerning many important matters connected with the application of cold. A great deal of experimental work still remains to be done in regard to such matters as atmospheric conditions, the circulation of air and ventilation, methods of packing and storage, &c. The difficulties experienced in the export of citrus fruits from Australia are well known.

Other problems which require investigation relate to the development of means whereby tropical fruits can be successfully stored and transported long distances. Any satisfactory investigation of the problems relating to the preservation and transport of fruit would necessitate

the co-operation, not only of the State Agricultural Departments, but also of the ship-owners and the authorities in England, since it is necessary that the work should cover all factors, from the orchard to the consumer.

4. *Report by Dr. F. Kidd and Dr. W. J. Young.*—The Council accordingly arranged with the British Department for Scientific and Industrial Research for Dr. F. Kidd, an officer of the British Food Investigation Board, to visit Australia in order to carry out a survey of the local problems, of the investigations already in progress, of the facilities available, &c., and to report on the whole question of the organization and development of investigations on cold storage problems in Australia.

By arrangment with the University of Melbourne, the Council secured the services of Dr. W. J. Young, Associate-Professor, Department of Bio-chemistry, so as to enable him to accompany Dr. Kidd and collaborate with him in his inquiries and report. Their report has been received, and is engaging the attention of the Council, which hopes to be able to proceed actively with the organization of investigations at an early date.

XVI.—INVESTIGATIONS ON FUEL PROBLEMS.

1. *General.*—In view of the serious national problem which has arisen as a result of Australia's dependence on other countries for the supply of her necessary liquid fuels, the Council has given a considerable amount of attention to the attitude it should adopt towards liquid fuel research, and in this connexion the question of the low-temperature distillation of coal and shale is of importance. It has been decided that in view of the high cost of the complicated plant that would be necessary, of the existence of such a plant at the British Fuel Research Station, Greenwich, and of the enormous amount of work which is being carried out on these problems in other countries, the Council would not be justified in undertaking experimental work for the present. Two Australian post-graduate research students have, however, been sent to the Greenwich Station, and steps have been taken to insure that the Council will be kept fully informed of all developments.

2. *Oil Shale.*—The Council has received many requests for assistance from various interests engaged in the oil shale industry in Australia. At the present time that industry is not generally being run with commercial success, and the requests have generally been for scientific assistance in the development of suitable retorts. The Council is co-operating with the Development and Migration Commission in an inquiry to ascertain what sections of the shale oil industry are chiefly responsible for its economic failure. It has been decided, provisionally, that if, as a result of this inquiry, it seems probable that economic conditions are such that the industry is likely to benefit as a result of a scientific investigation of certain aspects of it, the Council will make inquiries, and will give advice regarding the lines to be followed in such investigation.

3. *Power Alcohol.*—Careful consideration has also been given by the Council to possible lines of research that could appropriately be undertaken in regard to power alcohol. Broadly, it is considered that the problem of fermentation alcohol is mainly of an economic nature, and that there is little room for improvement of present processes by scientific investigation. As regards synthetic alcohol, it is felt that, as any investigation would involve costly apparatus, and as a great deal of work is being carried out in other countries, it is not appropriate for the Council to initiate researches at the present time. As regards the production of power alcohol from cellulose, however, investigations are being carried out, under the direction of Professor N. T. M. Wilsmore, University of Western Australia, on the hydrolysis and fermentation of the commoner Australian hardwoods. The preliminary work has been confined to a laboratory examination of the hydrolysis of karri sawdust by means of concentrated hydrochloric acid, and to a study of the quantity of resultant sugars. The results, so far obtained, are regarded as promising, and the investigations are being continued. The Council has published a Bulletin on the subject of power alcohol, compiled by Mr. G. A. Cook, M.Sc., B.M.E., Assistant-Secretary to the Council.

XVII.—OTHER INVESTIGATIONS.

1. *Australian Radio Research Board.*—In November, 1926, the Council convened a Conference for the purpose of obtaining advice as to the need for a Radio Research Board in Australia. The Conference was attended by delegates drawn from the Postmaster-General's Department, the Defence Department, Universities and broadcasting interests. It was of the opinion that the establishment of such a Board would be of advantage to all radio interests in Australia; that the primary function of the Board should be to originate, facilitate, and co-ordinate radio research investigations; and that the Board could with advantage direct its attention to (*a*) co-operation with the British Radio Research Board, and with the International

Union for Scientific Radio-Telegraphy; (*b*) consideration of scientific problems related to broadcasting in Australia; and (*c*) the improvement of equipment and other facilities available in Australia for electrical measurements at radio frequencies.

The resolutions of the Conference were approved at a subsequent meeting of the Council, when it was recognized that the chances of success of any Board that might be formed would be very considerably enhanced if it received the full co-operation of the Departments of Defence and of the Postmaster-General. On it being ascertained that these latter Departments would welcome the formation of a Board, the latter was formally constituted. The present members are as follows:—

Professor J. P. Madsen (Chairman), University of Sydney.
Professor T. H. Laby, University of Melbourne.
H. P. Brown, Esq., Secretary and Director, Postmaster-General's Department.
Electrical-Commander F. G. Cresswell, Department of Defence.

At the first meeting of the Board, held in June, 1927, the following preliminary programme of research was adopted:—

(i) Transmission phenomena, such as the determination of the height and other characteristics of the Heaviside layer locally; and a test of the interference theory of fading involving a repetition and extension of the Appleton experiment.

(ii) Field strength measurements in Victoria and in New South Wales.

The Board is also circularizing the various broadcasting and other radio interests in Australia as to what they are doing in regard to research, to what extent they desire co-operation, and what facilities they have available. It is also taking steps to bring about an effective co-operation with similar bodies in other countries; and, to that end, Professor Madsen, who left Australia in July, 1927, on a private visit to Europe and America, is now making inquiries.

2. *Geophysical Prospecting.*—Of late years, world-wide attention has been given to the use of geophysical methods in the prospecting for valuable minerals, oil, water, &c. In particular, the electrical, the magnetic, and the gravitometric methods have proved to be of no little promise. It is obvious that these developments are of particular importance to a country such as Australia, which is noted for the number and extent of its metalliferous areas.

At the request of the Council, Mr. H. W. Gepp, Chairman of the Development and Migration Commission, who had previously interested himself in the processes, inquired into the whole position during his visit to Europe in the last two or three months of 1926. As a result, he put forward a scheme, suggesting that the British and Australian Governments should co-operate financially in the application of geophysical methods in Australia; that, in the first place, the methods should be thoroughly tested on known areas in Australia; and that they might then be used in a systematic survey of others.

After preliminary inquiries had taken place as to the British authority which might appropriately co-operate, the matter was referred to the Empire Marketing Board. The latter, after obtaining favorable reports from its Research Committee and from a strong technical sub-committee working under the Committee of Civil Research, agreed to co-operate with Australia in an exhaustive trial of all geophysical methods of possible Imperial importance (as distinct from a survey of Australian resources). The Board further agreed to provide £10,000 for the first year and £6,000 for the second year, on the condition that the Commonwealth Government contributed a like sum. This offer has been accepted by the Commonwealth.

The Australian contributions will be administered through the Council for Scientific and Industrial Research and the Development and Migration Commission. The actual trials will be carried out under the direction of Mr. A. Broughton Edge, a consulting geologist, who has already had an extensive experience in prospecting by geophysical means. It is also intended that Australian graduates will be trained in the methods. Arrangements are now being made to obtain the services of two such graduates, one for training especially in gravitometrical methods and the other in electrical methods.

3. *Maintenance of Standards in Australia.*—Under the *Science and Industry Research Act* 1920–26, the functions of the Council include "the testing and standardization of scientific apparatus and instruments, and the carrying out of scientific investigations connected with standardization." In order to obtain authoritative advice on these matters, the Council, towards the end of 1926, convened a Conference of the Heads of the more important Australian Physical Laboratories. The Conference advised that the progress of Australia, its efficiency in industry, and the effectiveness of its defence system would be handicapped if some of the

facilities which other countries have in the shape of their National Physical Laboratories were not made available in Australia in the near future. The Conference felt, however, that the idea of immediately establishing an Australian National Physical Laboratory should be rejected, chiefly on the grounds that, in some respects, it would be an unnecessary duplication of personnel and equipment already existing in other Australian laboratories, and that the cost of its establishment would amount to a large sum. The Conference advised further, that to render effective the extensive and valuable work of the Australian Commonwealth Engineering Standards Association, and to provide for the sound development of technical and industrial work in Australia, it was almost imperative that immediate action should be taken in regard to the question of legal standards.

This advice has been considered by the Council, which has now formed a Committee in order, *inter alia*, that further action on matters relating to the maintenance of standards in Australia may be taken. The present constitution of the Committee —which has, so far, held only one meeting—is as follows :—

Professor J. P. Madsen (Chairman), University of Sydney.
Professor O. U. Vonwiller, University of Sydney.
Marcus Bell, Esq., Superintendent, Research Laboratories, Defence Department.
N. A. Esserman, Esq., Research Laboratories, Defence Department.

In July, 1927, the Chairman (Professor Madsen) left Australia on a private visit to Europe and America, and is taking advantage of this opportunity in order to inquire generally into matters relating to standards, and in order to obtain further information concerning apparatus that will be necessary in Australia.

4. *Pastoral Research.*—Important proposals for the initiation of research into the problems of the pastoral industry were made at meetings of representative bodies of that industry, held in Adelaide towards the end of June, 1927. Proposals for research, particularly certain suggestions that had been made by the Chairman of the National Council of Wool-selling Brokers, Mr. G. Aitken, had been discussed by individual members of the industry for some time previously.

In June, however, the Graziers Federal Council of Australia carried a resolution in favour of pastoral research in general. A few days later, the matter was again discussed at a combined meeting of the Australian Wool-growers' Council (President, Sir C. Graham Waddell) and the National Council of Wool-selling Brokers. On that occasion a description of the nutritional investigations he was undertaking on behalf of the Council for Scientific and Industrial Research was given by Professor Brailsford Robertson, and Australian animal diseases and research were discussed by Professor H. A. Woodruff. The individual members present also visited the Waite Agricultural Research Institute, where Professor A. E. V. Richardson outlined the work that was being done on the mineral deficiencies of pastures.

At the combined meeting, Mr. Aitken elaborated his ideas, and they were supported by Sir Graham Waddell and others. It was finally resolved as follows :—

"That a fund be raised by voluntary subscription to provide means and facilities for research, and other scientific activities and agencies for the improvement of methods and conditions in the pastoral and grazing industry throughout the Commonwealth of Australia, particularly in regard to diseases affecting stock (e.g., the fly pest); rabbits and other animal pests; edible plant life and harmful plant life; and any other object which will lead to the advancement of the pastoral industry."

"That a Committee be formed from amongst the members of the Australian Woolgrowers' Council and the National Council of Woolselling Brokers for the purpose of obtaining contributions to such fund."

"That an incorporated body to be called 'The Australian Pastoral Research Trust Limited,' be constituted, and registered for the purpose of receiving such fund from the Committee, and administering the same; and that the fund shall be invested by the company in authorized trust investments, and the income applied for such purposes set out above, provided that any excess corpus over £200,000 may also be used for such purposes if deemed necessary."

The Council has kept closely in touch with the above developments, and has sent a memorandum to leading pastoralists, suggesting the following points for consideration :—

(i) That a Pastoral Research (Sheep) Association be formed by the Pastoral Research Trust on the one hand, and Council for Scientific and Industrial Research on the other.

(ii) That each party undertakes to provide at least £10,000 per annum, for a period of years to be determined.

(iii) That the business direction of the Association and the determination of its policy and lines of work be in the hands of an Executive Committee composed of practical men (growers and brokers) and members of the Council.

(iv) That if this general idea appeals to the leaders of the pastoral movement, a Conference should be arranged between them and the Council to consider the matter further and possibly draw up a definite recommendation to submit to the Commonwealth Government, and the Growers' and Brokers' Councils.

5. *Offer of Land by Queensland Government.*—The Queensland Government has made a very generous offer to place at the disposal of the Council, for the purposes of scientific investigations on problems affecting the wool industry, an area of 25,000 acres of first-class sheep country in the Barcaldine district. In making this offer, the Premier of Queensland (the Hon. McCormack, M.L.A.) stated that the area in question is in the centre of the wool-producing districts of Queensland : that it comprises some of the best sheep-grazing land in the State ; and that its carrying capacity is one sheep to 2½ acres, or 10,000 sheep for the area mentioned. He suggested that the Council should be given a special lease of the area for a term of 30 years, without any restrictive conditions, except that the land must be used for sheep experimental purposes ; all proceeds therefrom to be devoted to these purposes. He also suggested that amongst the important problems which could be investigated on the area are the following :—

(i) Blow-fly pest.
(ii) Worms in sheep, and disease-prevention generally.
(iii) Natural grasses best suited for wool-production.
(iv) Artificial feeding and its effect on wool-production.
(v) Conservation of fodders, including natural grasses.
(vi) Stock licks.
(vii) The effects of overstocking on natural pastures.
(viii) The re-growth of natural grasses after depletion by drought or overstocking.
(ix) The advantages or otherwise of small paddocks for grazing sheep.
(x) The type of merino sheep best suited for Queensland climatic conditions, having regard to both frame and wool.
(xi) Generally other matters affecting the breeding and feeding of sheep and their influence on high-grade wool production.

The Council has considered very carefully the possibilities of utilizing the suggested area for a Research Station, realizing that it would not be justified in accepting the offer unless it could see quite definite openings for successful work. To that end, it has consulted, not only its own scientific advisers, but also many experienced men in Queensland, including the Council of the United Graziers' Association. Though at first impressed with the desirability of accepting the offer, it became apparent, on examination, that the work which could be carried out on the area would not justify the establishment of a Research Station on the lines suggested. In reaching this conclusion, the Council was, in particular, influenced by the following considerations :—

(i) That it is not advisable for the Council directly to engage in wool-growing for revenue purposes.
(ii) The Barcaldine district is generally free from sheep diseases, and would not be satisfactory for several of the investigations suggested.
(iii) Parasitological diseases do not exist in the area, and it would be folly to introduce them.
(iv) For the adequate study of natural grasses, a considerable number of small areas in different parts of Australia would be required.
(v) Artificial feeding is not generally necessary in the area, which would not therefore have any special value in investigations on that problem.
(vi) The investigation of the problem of fodder conservation is really an economic problem, and is not primarily a matter for research.
(vii) Investigations on the problem of stock-licks are provided for in the work which the Council has already initiated in co-operation with the Empire Marketing Board and the Waite Agricultural Research Institute on mineral deficiencies in fodders.

Looking at the matter broadly, the Council was convinced that, while in certain directions work of a useful nature might be carried out on the area in question, the balance of the evidence is very definitely against the acceptance of the Queensland Government's generous offer.

6. *Astronomical Work in Australia.*—On several occasions in recent years the Commonwealth Government has been approached by various organizations in regard to the astronomical work carried out in Australia. The Australian National Research Council has

also interested itself in the matter, and has received communications from Great Britain, in which attention has been drawn to the delay which has occurred in Australia in the fulfilment of certain astronomical obligations of an international nature, particularly those relating to the compilation of the Astrographic Catalogue.

In order to obtain advice on the whole position, the Council convened a meeting, in March last, of the leading Federal and State Astronomers of Australia. This Conference was of the opinion that the Commonwealth should take a more active interest in astronomical work, but at the same time it indicated that the present State Observatories should preserve their present entities. A feeling was also expressed that the Observatories should be associated with their respective Universities. The findings of the Conference were considered by the Council, which endorsed the opinions of the Conference, and also recommended that if the Commonwealth decides to take any action along the lines suggested, an eminent authority on astronomy should be invited to visit Australia, and to report on the best means of carrying out the suggestions.

7. *Pottery Investigations.*—A considerable amount of valuable work was carried out under the former Institute of Science and Industry on the utilization of Australian clays for the manufacture of higher grades of white china and earthenware. The present Australian market for whiteware is worth about £1,000,000 per annum, and the Council intends to proceed with the investigations. As a preliminary step, it has sent its investigator, Mr. R. C. Callister, to England for a special course of training at the Ceramic School at Stoke-on-Trent. He will return to Australia in November, 1927, and the question of the continuation and development of the investigations is under consideration by the Council.

8. *Artificial Building Stones.*—Towards the end of June, 1926, the Federal Capital Commission asked the Council to undertake the development of a working routine for the preparation of an artificial stone made up of granite chippings and cement. The Chairman of the Commission and others had seen examples of such stone in the United States, and were of the opinion that it could be used in buildings at Canberra. The Council accordingly appointed a Committee (Sydney), consisting of Mr. J. Nangle (Chairman), Sir John Harrison, Messrs. R. Boan, F. Kneeshaw, J. Peddle, and H. J. Swain, to consider the matter. As a result certain investigations have been initiated at the Sydney Technical College. From the results obtained to date it would appear that synthetic stone closely resembling natural sandstone can be readily made by selecting suitable grades of sand and using white Portland cement, or in some cases a mixture of white and grey, as a cementing medium. Artificial stone resembling granite, however, is a much more difficult problem. A number of experiments have been made with various grades of aggregates, varying in size down to practically coarse sand, and the best results so far have been obtained with the fine material. The work is being continued.

9. *Dairy Research.*—Suggestions have been made by various persons that the Council should undertake investigations in connexion with the dairying industry. In some cases these suggestions related, not so much to scientific research work of a nature which would appropriately come within the scope of the Council's functions as to the need for the application of existing knowledge for the improvement of conditions in the dairying industry, both on the farm and in the factory. Representatives of the Council have attended several conferences, at which various proposals have been discussed ; but, viewing the matter solely from the aspect of research, and after obtaining advice from authoritative sources, the Council did not concur with the proposals made at these conferences. The matter has been taken up by the Council, in consultation with the Chairman (Mr. G. A. Julius) and Professor A. E. V. Richardson in England, and the Council is formulating proposals for the initiation of dairy research, in the carrying out of which it hopes to secure the co-operation of other interested bodies.

10. *Miscellaneous.*—The Council has also given attention to a large number of other matters, and has acted as adviser to the Commonwealth Government on many subjects connected directly and indirectly with scientific work. In addition, it regularly supplies information on a great variety of subjects in reply to inquiries received from the public regarding scientific and technical matters, especially concerning new processes, manufacturing difficulties, and the utilization of new raw materials or substitutes therefor. Many of these inquiries involve a considerable amount of bibliographical research work. The number of them received shows that the Council has come to fill a place in the needs of the community in this class of work.

XVIII.—MISCELLANEOUS.

1. *Library.*—The Library of the Council now contains some 5,000 volumes, including text books and bound periodicals, a number of which are not available in other libraries in the Commonwealth.

The question of the future development of the Library has been considered by the Council in a preliminary way, and Professors Agar and Laby, of the Melbourne University, were asked to advise on the matter. After inspection of the Library they furnished a report, stating that owing to the uncertainty regarding the establishment by the Council of special laboratories for research work, and the date of the removal of the Council's head-quarters to Canberra, it was impracticable to furnish definite advice regarding the immediate development of the Library. They submitted suggestions, however, for the establishment of a general borrowing system for scientific periodicals throughout the Commonwealth, the Council to act as the agency through which borrowing should be arranged. For the successful inauguration of the scheme, it would be necessary for the Council to obtain the co-operation of all the important libraries in Australia. It is considered that the present time is not opportune for the inauguration of the scheme. In the meantime, the Library is being developed along the same lines as in the past, and the publications received, both by subscription and exchange, show a steady increase.

2. *Catalogue of Scientific Periodicals.*—In 1921, the former Institute of Science and Industry completed the compilation of a card catalogue of all the scientific and technical periodicals in the public and semi-public libraries of the Commonwealth. No funds were, however, available for the publication of the index in book form, as was originally intended. The Council has decided that the catalogue shall be brought up to date and published, and the necessary funds have now been provided for that purpose.

The Chief Librarians of the Public Libraries of Sydney, Adelaide, Perth, and Hobart, and Professor H. C. Richards, as Chairman of the State Committee of Brisbane, have kindly consented to superintend the work of revision for their respective States. For the task of general editing and for the revision of the Victorian section of the catalogue, the services of Mr. E. R. Pitt, M.A., of the Melbourne Public Library—who is responsible for the original compilation of the catalogue—have been secured. It is hoped that the catalogue will be complete by the end of June, 1928.

3. *Publication of Results of Investigations Carried out by Council.*—The Council has decided that it will undertake full responsibility for the publication of the results of work carried out by its officers. The publications will consist of three main types. Firstly, there will be Bulletins, in which the results of completed researches will be carried out. Secondly, there will be Pamphlets, which will relate to matters of less importance than those published in Bulletins, and which might consist of compilations. Thirdly, there will be papers published in the quarterly *Journal*, relating to incompleted investigations, &c., in which a definite stage of the work has been reached. It has also been decided that officers of the Council may, with the approval of the Council, publish papers in other journals.

The following publications have been issued by the Council :—

(i) *Bulletins*—

No. 30.—An investigation of the bunchy-top disease in the banana; by C. J. P. Magee, B.Agr.Sc.

No. 31.—Newsprint—Preliminary experiments on the grinding of immature eucalypts for mechanical pulp and the possibilities of manufacturing newsprint in Australia; by L. R. Benjamin.

No. 32.—A survey of the tanning materials of Australia; by D. Coghill.

No. 33.—The possibilities of power alcohol and certain other fuels in Australia; by G. A. Cook, M.Sc., B.M.E.

(ii) *Circulars*—

No. 9.—Preliminary report on the treatment of redgum or marri kino (Eucalyptus calophylla) for the preparation of tannin extract; by D. Coghill.

No. 10.—Report by the Meat Freezing Committee of the Australian National Council on the Bullot process for the preservation of meat.

(The numbering of the above Bulletins and Circulars is a continuation of the previous issues of the former Institute of Science and Industry. It is intended to discontinue the series of Circulars.)

(iii) *Quarterly Journal.* Vol. I., No. 1. August, 1927.

In addition to these printed publications, the Council issues a confidential *Monthly Summary*, furnishing information, in convenient and succinct form, regarding developments in the Council's work. Copies of these Monthly Summaries are sent to members of the Council

and of its State Committees and to the principal scientific and technical officers of the Council. They thus enable all those who are directly connected with the Council's organization to keep themselves informed as to the progress of its work and activities.

4. *Liaison Arrangements in Great Britain.*—Mr. F. L. McDougall, C.M.G., who is a member of the Imperial Economic Committee, has been appointed as (part-time) Liaison Officer at Australia House, London, jointly for the Council and for the Development and Migration Commission. He has been provided with the services of a scientific assistant (Mr. A. S. Fitzpatrick, M.Sc., Ph.D.) and of a clerical assistant (Mr. A. W. Stuart Smith). Mr. McDougall and his officers have furnished the Council with a considerable number of valuable reports on various matters. Their services have been of special value in connexion with the carrying out of inquiries, on an Imperial basis, by the British Empire Marketing Board relating to scientific matters in Australia, and with negotiations with that Board in connexion with the organization of co-operative investigations.

The Empire Marketing Board was constituted in May, 1926, upon the recommendation of the Imperial Economic Committee, for "furthering the marketing in this country"—Great Britain—"of Empire products." In 1926, it received a grant of £500,000, and a grant of £1,000,000 has been promised for 1927 and future financial years. The Board has made a number of grants for scientific research into problems of production and marketing in various parts of the Empire. It is already contributing towards the cost of the Council's investigations on mineral deficiencies in pastures, and an offer to contribute towards the cost of a Tropical Agricultural Research Station in Australia has been accepted. The question of contributions by the Board towards the cost of other investigations in Australia is being discussed by Mr. G. A. Julius and Professor A. E. V. Richardson in London with the British authorities and with Mr. McDougall.

5. *Finance.*—Statement of Expenditure from 1st July, 1926, to 30th June, 1927:—

	£	£
1. Salaries and contingencies		10,648*
2. Remuneration of Chairman and Members of Council		2,761†
3. Contributions to Imperial Scientific Bureaux, International Research Councils and Unions, Pan-Pacific Science Congress in Japan, &c.		2,675†
4. Investigations—		
(1) Stock diseases and pests—		
(*a*) Cattle tick	275	
(*b*) Buffalo-fly	500	
(*c*) Tuberculosis in cattle	523	
(*d*) Animal nutrition, including mineral deficiency in pastures	2,073	
(*e*) Parasitic diseases	344	
(*f*) Blow-fly	410	
(*g*) Paralysis in pigs	241	
(*h*) Caseous lymphadenitis	178	
(*i*) Entomological work	222	
(*j*) Stock investigations in Tasmania	426	
(*k*) Miscellaneous	172	
		5,364
(2) Plant diseases and botanical investigations—		
(*a*) Bunchy-top in bananas	250	
(*b*) Tomato wilt—		
Capital	1,541	
Maintenance	446	
(*c*) Diseases of peas and hops	118	
(*d*) Grass grub and lucerne flea	270	
(*e*) Survey of plant problems	140	
(*f*) Miscellaneous	122	
		2,887

* The main items of expenditure under this heading are salaries of the Administrative Staff at the Council's head offices; staff and upkeep of State Committee offices; staff at Australia House; and travelling expenses of head-office staff, members of the Council, &c. The sum of £10,648 was provided as follows:—

From Consolidated Revenue Fund	£6,366
,, Science and Industry Investigation Trust Account	4,282
Total	£10,648

† Provided from Consolidated Revenue Fund.

(3) Prickly-pear pest		6,000
(4) Horticultural including irrigation investigations—		
(*a*) Murray River Inquiry Commission ..	212	
(*b*) Dried fruit grub investigation ..	102	
(*c*) Citrus and soils investigation ..	1,234	
(*d*) Viticultural investigations	1,348	
		2,896‡
(5) Food preservation and cold storage—		
(*a*) Survey of field of research by experts	1,641	
(*b*) Meat-freezing experiments	340	
(*c*) Miscellaneous	10	
		1,991
(6) Fuel investigations—		
Hydrolysis of hardwoods		28
(7) Forest products investigations—		
(*a*) Paper pulp	2,355	
(*b*) Tannin extract and tanning ..	2,917	
		5,272
(8) Mining and metallurgy—		
(*a*) Clays and pottery	526	
(*b*) Mineragraphic investigations ..	217	
		743
(9) Miscellaneous expenditure on minor investigations		666
(10) Catalogue of scientific periodicals..		84
(11) Library		989
(12) Maintenance of research laboratories at Brunswick ..		562
(13) Training of research workers abroad		1,518
Total of Item 4		£29,000§

Grand Total of Expenditure.

From Science and Industry Investigation Trust Account	£33,282
From Consolidated Revenue Fund	11,802
	£45,084

6. *Staff.*—The following list of officers is exclusive of typists, laboratory assistants, labourers, &c.—

1. Head Office Staff.

Chief Executive Officer—A. C. D. Rivett, M.A., D.Sc.
Secretary—G. Lightfoot, M.A.
Assistant Secretary—G. A. Cook, M.Sc., B.M.E.
Entomologist—G. F. Hill.
Senior Clerk—H. P. Breen.
Librarian—Miss E. Archer, M.Sc.
Accounts Clerk—R. W. Constable.
Records Clerk—H. T. Chadwick.
Records Clerk—P. Domec Carré.

2. Secretaries of State Committees.

New South Wales—
University of Sydney—Brig.-General I. G. Mackay.
Victoria—
314 Albert-street, East Melbourne—G. A. Cook, M.Sc., B.M.E.
Queensland—
William-street, Brisbane—Miss H. Todd.

‡ To be reduced by proceeds sale of fruit crop, estimated at £800.
§ Provided from Science and Industry Investigation Trust Account.

South Australia—

University of Adelaide—E. V. Clark, B.Sc.

Western Australia—

Box K.766, G.P.O., Perth—L. W. Phillips, M.Sc.

Tasmania—

Hydro-Electric Dept., Hobart—F. J. Carter.

3. Australia House, London.

Liaison Officer—F. L. McDougall, C.M.G. (part time).
Scientific Assistant—A. S. Fitzpatrick, M.Sc., Ph.D.
Clerical Assistant—A. W. Stuart Smith.

4. Animal Nutrition Investigations.

At the University of Adelaide—

Officer-in-Charge—Professor T. B. Robertson, Ph.D., D.Sc.
Chief Assistant—J. Ward Walters.
Field Officer—E. W. Lines, B.Sc.
Biological Officer—H. R. Marston (part time).
Statistical Recorder—Miss K. B. Moore.
Assistant—J. D. O. Wilson.

In Queensland—

Veterinary Officer—J. E. Thomas, B.Sc., B.V.Sc., B.Agr.Sc.

At the Waite Agricultural Research Institute—

Agronomist—K. M. Fraser, B.Agr.Sc.
Analytical Chemist—R. E. Shapter, A.A.C.I.

5. Veterinary Investigations.

At University of Sydney—

Parasitologist—I. Clunies Ross, B.V.Sc.

Glenfield Research Institute, New South Wales—

Veterinary Officer—W. A. Carr Fraser, B.V.Sc. (on loan to the New South Wales Department of Agriculture).

Sheep Blow-fly Investigations, New South Wales—

Veterinary Officer—C. R. Mulhearn, B.V.Sc. (on loan to New South Wales Department of Agriculture).

Entomologist—K. C. Richardson (on loan to New South Wales Department of Agriculture).

Department of Veterinary Science, University of Sydney—

Veterinary Officer—R. C. Cramp, B.V.Sc. (on loan from New South Wales Metropolitan Meat Industry Board).

Melbourne University Veterinary Research Institute—

Veterinary Officer—T. S. Gregory, B.V.Sc.

Adelaide Hospital Pathological Laboratory—

Veterinary Officer—G. C. Dickinson, B.V.Sc.

Kimberley Horse Disease in Western Australia—

Veterinary Officer—D. Murnane, B.V.Sc.

6. Plant Problems.

Waite Agricultural Research Institute—

Assistant Plant Pathologist—H. A. Pittman, B.Agr.Sc.

7. Irrigation Settlement Problems.

Waite Agricultural Research Institute—

Soil Survey Officer—J. K. Taylor, M.Sc., M.Agr.Sc., B.A.

Assistant Soil Survey Chemist—H. N. England, B.Sc. (in training for subsequent appointment at Griffith).

Commonwealth Research Station, Griffith—

Liaison Officer—F. K. Watson, M.A., B.Sc., A.M.Inst.C.E. (part time).
Officer-in-Charge—E. S. West, M.Sc.
Accountant—D. Chalmers (part time).
Orchard Superintendent—B. H. Martin.
General Assistant—W. B. Tart.

Commonwealth Research Station, Merbein—

Officer-in-Charge—A. V. Lyon, M.Agr.Sc.
Secretary and Field Officer—J. E. Giles.

8. Forest Products Investigations.

Paper Pulp Research Laboratory, Brunswick—

Officer-in-Charge—L. R. Benjamin.
Chemist—W. E. Cohen, B.Sc.
Chemist—J. Somerville, B.Sc.
Chemist—T. Hodgkinson, B.Sc.
Chemist—R. B. Jeffreys, B.Sc.

Tannin Extract Investigations, Western Australia—

Chemist—D. Coghill.

9. Other Investigations.

Mineragraphic Investigations—F. L. Stillwell, D.Sc. (seconded to Development and Migration Commission for twelve months as from 1st August, 1927).

Pottery Investigations—R. C. Callister (undergoing training abroad).

7. *Acknowledgments*—The work of the Council, particularly in its initial stages, has been facilitated materially by the fact that a great deal of the necessary preparatory steps had already been taken by the original (temporary) Advisory Council of Science and Industry, which came into existence in 1916, and by the Institute of Science and Industry, which was created by an Act of 1920. A large amount of valuable work had been carried out by these two bodies, not only in preparing the ground for the investigations of many important problems, but also in initiating research work on certain problems, which work has been continued by the Council, such, for example, as the investigations on the biological control of prickly-pear and on the production of paper-pulp from Australian timbers.

The Council has also derived very great assistance from the close co-operation which has been established with the Development and Migration Commission. In connexion with many proposals for research work which have come before the Council, valuable information and help have been rendered by that Commission and its officers. The Council, has, moreover, established the closest co-operative relations with Commonwealth and State Departments concerned with scientific and technical work, with the Universities, the Australian National Research Council, and other scientific bodies in the Commonwealth. Without that co-operation and assistance it would have been impracticable for the Council to have carried on its work effectively.

A. C. D. RIVETT, Deputy Chairman.

G. LIGHTFOOT, Secretary.

Council for Scientific and Industrial Research,
314 Albert-street, East Melbourne.
30th September, 1927.

APPENDIX I.

THE COMMONWEALTH OF AUSTRALIA.

The *Science and Industry Research Act* 1920–1926,(*a*)
being
The *Institute of Science and Industry Act* 1920
(No. 22 of 1920),
as amended by
The *Science and Industry Research Act* 1926
(No. 20 of 1926).(*b*)

An Act relating to the Commonwealth Institute of Science and Industry,

[Assented to 14th September, 1920].(*c*)

BE it enacted by the King's Most Excellent Majesty, the Senate, and the House of Representatives of the Commonwealth of Australia, as follows :—

PART I.—PRELIMINARY.

Short title amended by No. 32, 1918, s. 2, and No. 20, 1926, s. 1 (3.).

1. This Act may be cited as the *Science and Industry Research Act* 1920–1926.(*a*)

2. This Act is divided into Parts as follows :—

Part I.—Preliminary.

Amended by No. 20, 1926, s. 2.

Part II.—The Commonwealth Council for Scientific and Industrial Research.

Part III.—Powers and Functions of the Council.

Part IIIA.—State Committees.

Part IV.—Miscellaneous.

Amended by No. 20, 1926, s. 3.

3. In this Act, unless the contrary intention appears—

"Officer" means any person employed under this Act ;

"The Council" means the Commonwealth Council for Scientific and Industrial Research.

Heading and Part substituted by No. 20, 1926, s. 4.

PART II.—THE COMMONWEALTH COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

4.—(1) There shall be a Commonwealth Council for Scientific and Industrial Research, which shall be a body corporate with perpetual succession and a common seal and capable of suing and being sued.

Substituted by No. 20, 1926, s. 4.

(2.) All Courts, Judges and persons acting judicially shall take judicial notice of the seal of the Council affixed to any document or notice, and shall presume that it was duly affixed.

(3.) The Council shall, subject to this Act, have power to hold lands, tenements and hereditaments, goods, chattels and any other property for the purpose of and subject to this Act.

(4.) The Council shall have power to acquire by gift, grant, bequest or devise, any such property for the purposes of this Act, and to agree to any conditions of such gift, grant, bequest or devise.

(5.) The powers of the Council under the last preceding sub-section shall be exercised subject to the regulations and the approval of the Minister.

(6.) Any property which was, immediately prior to the commencement of this section, vested in the Commonwealth Institute of Science and Industry shall, upon that commencement, become vested in the Council.

Substituted by No. 20, 1926, s. 4.

5.—(1) The Council shall consist of the following members :—

(*a*) three members nominated by the Minister and appointed by the Governor-General, one of whom the Governor-General shall appoint to be Chairman of the Council ;

(*b*) the Chairman of each State Committee constituted under this Act ; and

(*c*) such other members as the Council, with the consent of the Minister, co-opts by reason of their scientific knowledge.

(*a*) The *Science and Industry Research Act* 1920–1926 comprises the *Institute of Science and Industry Act* 1920 (No. 22 of 1920), as amended by the *Science and Industry Research Act* 1926 (No. 20 of 1926) See Act No. 20, 1926, s. 1 (3.).

(*b*) Assented to 21st June, 1926.

(*c*) This is the date of assent to the *Institute of Science and Industry Act* 1920.

(2.) The members appointed by the Governor-General on the nomination of the Minister shall hold office for a period not exceeding five years and shall be eligible for re-appointment.

(3.) A member co-opted in pursuance of paragraph (*c*) of sub-section (1.) of this section shall hold office for the period specified at the time of his co-option.

6.—(1) The Council shall meet at such times and places as the Minister determines. Substituted by No. 20, 1926, s. 4.

(2.) Five members of the Council shall constitute a quorum for the transaction of the business of the Council.

7.—(1) The Chairman and other members of the Council shall receive such remuneration and expenses as are fixed by the Governor-General. Substituted by No. 20, 1926, s. 4.

(2.) The Consolidated Revenue Fund is, to the extent necessary to provide for payment of the remuneration of members of the Council hereby appropriated accordingly.

8.—(1) There shall be an Executive Committee of the Council consisting of the members of the Council appointed by the Governor-General on the nomination of the Minister. Substituted by No. 20, 1926, s. 4.

(2) The Executive Committee shall have and may exercise, between meetings of the Council, all the powers and functions of the Council.

9. Upon the death or retirement of any member of the Council during his term of office— Substituted by No. 20, 1926, s. 4.

(*a*) in the case of a member appointed by the Governor-General on the nomination of the Minister—the Governor-General may on the like nomination appoint a person to hold the vacant office until the expiration of the term of the member who has died or retired ; and

(*b*) in the case of any other member—the deputy Chairman (if any) of the State Committee shall hold the vacant office until the appointment of a Chairman of that Committee.

10. In case of the illness, suspension or absence of a member of the Council the Governor-General may appoint a person to act as the deputy of the member during his illness, suspension or absence, and the deputy shall, while so acting, have and may exercise all the powers and functions of the member. Substituted by No. 20, 1926, s. 4.

10A. The Governor-General may at any time remove a member of the Council from his office for proved misbehaviour or incapacity. Inserted by No. 20, 1926, s. 4.

Part III.—Powers and Functions of the Council.

Heading amended by No. 20, 1926, s. 5.

11.—(1) The Council may make recommendations to the Minister as to— Amended by No. 20, 1926 s. 6.

(*a*) its policy and work ;

(*b*) the funds required for carrying out the work of the Council ; and

(*c*) the allocation of funds made available for carrying out that work.

(2.) The powers and functions of the Council shall, subject to the regulations and to the approval of the Minister, be—

(*a*) the initiation and carrying out of scientific researches in connexion with, or for the promotion of, primary or secondary industries in the Commonwealth ;

(*b*) the training of research workers and the establishment and awarding of industrial research studentships and fellowships ;

(*c*) the making of grants in aid of pure scientific research ;

(*d*) the recognition or establishment of associations of persons engaged in any industry or industries for the purpose of carrying out industrial scientific research and the co-operation with and the making of grants to such associations when recognized or established ;

(*e*) the testing and standardization of scientific apparatus and instruments, and the carrying out of scientific investigations connected with standardization of apparatus, machinery, materials and instruments used in industry ;

(*f*) the establishment of a Bureau of Information for the collection and dissemination of information relating to scientific and technical matters ;

and also that of acting as a means of liaison between the Commonwealth and other countries in matters of scientific research.

12. The Council shall, as far as possible, co-operate with the existing State organizations in the co-ordination of scientific investigation, with a view to— Amended by No. 20, 1926, s. 7.

(*a*) the prevention of unnecessary overlapping ; and

(*b*) the utilization of facilities and staffs available in the States.

Heading and Part inserted by No. 20, 1926, s. 8.

PART IIIA.—STATE COMMITTEES.

12A.—(1) The Governor-General may appoint a State Committee in each State consisting of such number of members as is prescribed.

Inserted by No. 20, 1926, s. 8.

(2.) The terms of the appointment of members and the method of appointment of the Chairman of each State Committee shall be as prescribed.

Inserted by No. 20, 1926, s. 8.

12B. The function of each State Committee shall be to advise the Council with regard to—

(*a*) the general business of the Council; and

(*b*) any particular matter of investigation and research.

PART IV.—MISCELLANEOUS.

13. The Governor-General may arrange with the Governor of any State for any of the following purposes:—

(*a*) the utilization for the purposes of this Act of State Research Departments and Laboratories and Experimental Stations and Farms;

(*b*) the co-operation in industrial and scientific research with State Government Departments, Universities and Technical Schools; and

(*c*) the co-operation with educational authorities and scientific societies in the Commonwealth with a view to—

(i) advancing the teaching of science in schools, technical colleges and universities where the teaching is determined by those authorities;

(ii) the training of investigators in pure and applied science and of technical experts, and

(iii) the training and education of craftsmen and skilled artisans.

Substituted by No. 20, 1926, s. 9.

14.—(1) The Council may, with the approval of the Minister, appoint such Investigators and Committees of Investigation as it deems necessary for the purposes of this Act.

(2.) Investigators and Committees of Investigation shall be appointed upon such terms and conditions as are approved by the Minister.

Inserted by No. 20, 1926, s. 9.

14A.—(1) The Council may, with the approval of the Minister, appoint such officers as it thinks necessary for the purposes of this Act.

(2.) Officers employed under this Act shall not be subject to the *Commonwealth Public Service Act* 1922–1924, but shall be engaged for such periods and shall be subject to such conditions as are prescribed.

(3.) An officer of the Commonwealth Public Service or of the Public Service of a State who becomes an officer under this Act shall retain all his existing and accruing rights.

(4.) An officer appointed under this Act shall be deemed to be an "employee" within the meaning of section four of the *Superannuation Act* 1922–1924 unless the Council, at the time of the appointment of the officer, notifies him in writing that he is not to be deemed such an employee.

Amended by No. 20, 1926, s. 10.

15. All discoveries, inventions and improvements in processes, apparatus and machines made by officers of the Council shall be vested in the Council as its sole property, and shall be made available under such conditions and payment of such fees or royalties or otherwise as the Governor-General determines.

Amended by No. 20, 1926, s. 11.

16.—(1) The Council may pay to successful discoverers or inventors working as officers of the Council or under the auspices of the Council such bonuses as the Governor-General determines.

(2.) Bonuses payable under this section shall be paid out of moneys appropriated by Parliament for the purpose.

Amended by No. 20, 1926, s. 12.

17. The Council may charge such fees and may agree to such conditions as it thinks fit for special investigations carried out at the request of any authority, institution, association, firm or person.

Inserted by No 20, 1926, s. 13.

17A. For the purposes of scientific and industrial investigations carried out in pursuance of this Act there is hereby appropriated from the Consolidated Revenue Fund the sum of Two hundred and fifty thousand pounds.

Inserted by No. 20, 1926, s. 13.

17B.—(1) The amount appropriated by the last preceding section shall be paid into and form part of a Trust Account to be known as the Science and Industry Investigation Trust Account.

(2.) The Trust Account established by this section shall be a Trust Account within the meaning of section sixty-two A of the *Audit Act* 1901–1924.

(3.) No money shall be expended from the Trust Account established by this section except in accordance with estimates of expenditure which have been passed by both Houses of the Parliament.

18. The Council shall, once in every year, make a report to the Minister containing a summary of the work done and researches and investigations made and proceedings taken by the Council during the preceding year. Amended by No. 20, 1926, s. 14.

19. The Minister shall cause the yearly report of the Council to be laid before both Houses of the Parliament within thirty days after the receipt thereof if the Parliament is then sitting, and if not, within thirty days after the next meeting of the Parliament. Amended by No. 20, 1926, s. 15.

20. The Council may publish such information relating to any matter investigated by it as it thinks fit, except where such publication would be contrary to conditions agreed to under section seventeen hereof. Amended by No. 20, 1926, s. 16.

21. The Governor-General may make regulations not inconsistent with this Act, prescribing all matters which are required or permitted to be prescribed or which are necessary or convenient to be prescribed for carrying out or giving effect to this Act, and in particular for prescribing such additional powers and duties of the Council as he deems desirable. Amended by No. 20, 1926, s. 17.

APPENDIX II.

Science and Industry Research Act 1920–1926.

Statutory Rules 1926, No. 125, as amended by Statutory Rules 1927, No. 38, and 1927, No. 57.

Science and Industry Research Regulations.

1. These Regulations may be cited as the Science and Industry Research Regulations. Short title.

2. In these Regulations, unless the contrary intention appears, "the Act" means the *Science and Industry Research Act* 1920-1926 as amended from time to time. Definition.

3.—(1) A State Committee shall consist of a Chairman and not more than fifteen members, exclusive of *ex officio* members. Constitution of State Committees and terms of appointment.

(2) The Chairman shall be appointed by the Governor-General on the nomination of the Minister.

(3) The State Government shall have the right of nominating three members from the staffs of its Scientific Departments.

(4) The Australian National Research Council shall have the right of nominating three members, eminent in science, of whom at least two shall be members of the staff of the University in the State.

(5) The Chairman and such members as may have been nominated under sub-regulations (3) and (4) of this regulation shall have the right of nominating three members associated with industry.

(6) A State Committee, with the consent of the Executive Committee of the Council for Scientific and Industrial Research, may co-opt further members, not exceeding six, by reason of their special qualifications.

(7) Members of the Executive Committee shall be *ex officio* members of all State Committees.

(8) Co-opted members of the Council shall be *ex officio members of the* State Committees of the States in which they reside.

(9) Members of the State Committees when travelling on the business of the Council shall be paid the cost of their conveyance together with an allowance at the rate of two guineas per day.

(10) The first Chairman of a State Committee shall be appointed for a term of one year, and thereafter each appointment of Chairman shall be for a term of three years.

(11) Of the three members first nominated under sub-regulation (3), (4), and (5) respectively of this regulation one member shall be appointed for a term of three years, one for a term of two years, and one for a term of one year, and thereafter each member shall be appointed for a term of three years.

(12) Members co-opted under sub-regulation (6) of this regulation shall hold office for such terms, not exceeding three years, as are determined by the State Committee co-opting such members.

Salary and period of appointment of Chief Executive Officer.

3A.—(1) The Chief Executive Officer shall be paid such salary as the Council, with the approval of the Minister, determines.

(2) The period of engagement of the officer holding the office of Chief Executive Officer shall be the period from the date of his appointment until the attainment by him of the age of sixty years.

Salaries and periods of appointment of officers.

4.—(1) Subject to these Regulations officers employed under the Act other than the Chief Executive Officer shall be engaged for such periods and shall be paid such salaries and allowances and shall be subject to such conditions as the Council, with the approval of the Minister, determines.

(2.) All officers employed under the Act shall hold office subject to good behaviour and compliance with these Regulations.

Increments.

5. Where the terms of appointment of an officer do not provide for the payment of increments, such increments may be paid, subject to the necessary appropriation by Parliament, as the Council, with the approval of the Minister, determines.

Powers of Council in regard to expenditure.

6. The Council shall have power to expend at its sole discretion, from moneys standing to the credit of the Science and Industry Investigation Trust Account, sums not exceeding One hundred pounds in each case, on any matters or subjects of investigation or on apparatus connected with any work of the Council, for which provision has been made in the Estimates of expenditure which have been passed by both Houses of the Parliament.

APPENDIX III.

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

Resolutions Passed by Conference on Agricultural Research.

(Convened by the Council and held at Melbourne on the 23rd and 24th March, 1927).

The following were present :—

Chairman.

Mr. G. A. Julius, Chairman, Council for Scientific and Industrial Research.

New South Wales.

Mr. G. D. Ross, Under-Secretary, Department of Agriculture.
Dr. Darnell-Smith, Biologist, Department of Agriculture.
Acting Professor H. L. Waterhouse, University of Sydney.

Victoria.

Dr. S. S. Cameron, Director, Department of Agriculture.
Mr. H. A. Mullett, Superintendent, Department of Argiculture.
Professor S. M. Wadham, University of Melbourne.

Queensland.

Mr. A. E. Graham, Under-Secretary, Department of Agriculture and Stock.
Mr. H. T. Easterby, Director, Bureau of Sugar Experiment Stations.
Professor E. J. Goddard, University of Queensland.

South Australia.

Professor A. J. Perkins, Director, Department of Agriculture.
Mr. W. J. Spafford, Department of Agriculture.
Professor A. E. V. Richardson, Director, Waite Agricultural Research Institute.
Professor J. A. Prescott, Waite Agricultural Research Institute.
Professor T. G. B. Osborn, University of Adelaide.

Western Australia.

Mr. G. L. Sutton, Director, Department of Agriculture.
Professor J. W. Paterson, University of Western Australia.

Tasmania.

Mr. F. E. Ward, Director, Department of Agriculture.
Mr. Gillies, Department of Agriculture.

Council for Scientific and Industrial Research.

Professor A. C. D. Rivett.
Mr. G. Lightfoot.

Secretary.

Mr. G. A. Cook.

1. This Conference is of the opinion that, in view of the number and magnitude of the problems confronting the agricultural and live-stock industries of Australia, Commonwealth participation in agricultural research is desirable.

2. The field for investigation of agricultural problems is almost unlimited in scope. In this field there are many problems which are regional or national in range or scope, fundamental in character, and which require concentration of effort and highly specialized research for their solution. These problems are specially suited for investigation by the Commonwealth.

3. The research problems confronting the agricultural and live-stock industries may be classified broadly into three categories :—(i) Investigation of the principles governing the practice of farming and the rearing and feeding of stock. (ii) The production of new varieties or breeds of plants or animals. (iii) The investigation of diseases of plants and animals with a view to control.

I. *Investigation of Principles Underlying the Practice of Agriculture and Live Stock Husbandry.*—This group of problems covers an exceedingly wide range, namely, soil problems, plant biology, production of farm crops, introduction of new plants and animals, plant nutrition (including improvement of pastures), dairying, horticulture, apiculture, animal nutrition, and agricultural economics.

Investigations in this field, which are of a more or less fundamental character, and which are national in scope, should be conducted by the Commonwealth, whilst problems of a more or less local character and which involve the application of existing knowledge, should be undertaken by the State Departments of Agriculture.

II. *Protection of New Varieties or Breeds of Plants and Animals.*—(i) *Plants.*—Much valuable work has been accomplished by various State Departments of Agriculture, and many new and valuable varieties of wheat have been produced which have already led to a considerable increase in wheat production.

This work should be encouraged and extended to include other farm crops which have not been subjected to such intensive work. Two distinct types of problems are involved—

(*a*) *Plant Genetics.*—An investigation of the botanical, morphological, and other characters of plants grown in Australia and an investigation of the genetic factors involved in disease resistance.

(*b*) *Plant Breeding.*—The application of scientific principles to the systematic improvement of existing varieties.

The former group of problems (Plant Genetics) should be carried out by the Commonwealth. The latter (Plant Breeding) should be carried out by existing organizations.

(ii) *Animals.*—A somewhat similar division of problems may be made regarding animals—

Animal Genetics.—The genetic analysis of the economic characters of live stock, including the meat quality and milk yield of cattle, wool quality and yield of wool and carcass of sheep, egg and meat quality and yield of poultry, and the like, constitute a group of research problems which are of national importance and require highly specialized research for their solution, and form an appropriate field for Commonwealth investigation.

Animal Breeding.—The application of existing knowledge of principles to the breeding and improvement of farm animals. This field of work should be left to existing State Departments of Agriculture.

III. *Disease and its Control.*—The field work in connexion with diseases in plants and animals is vast and must increase with the intensification of production.

Plant Diseases, Plant Pathology and Entomology.—The problems associated with disease in plants may be divided broadly into two fields—(i) Investigation of the life-history of the causal organism, the mode of infection, and conditions of attack, with a view to suggesting control measures. (ii) The application of known principles to the elimination of insect, fungus, or other pests within definite regions. The former problems are specially suited for Commonwealth investigation while the latter should be carried out by the State institutions.

Animal Diseases.—Investigations and work on animal diseases might be regarded as within the sphere of the Commonwealth, and they should be conducted in association with the States as regards field work.

4. The Council for Scientific and Industrial Research could render a service to the agricultural institutions of the Commonwealth by acting as a clearing house for information on research projects in progress in State institutions and Universities. The States should supply information on research projects in hand or contemplated, and the Commonwealth should supply the States with similar information regarding its projects in agricultural research.

5. The Commonwealth could also render a service to Australian agriculture by issuing a Journal of Australian Scientific Research which would afford a means for the publication of papers on agricultural science, which are too technical for inclusion in State Departmental Journals, or which are not of sufficient international importance to be included in the scientific journals abroad.

6. In view of the great number of Australian agricultural problems remaining unsolved, and the great difficulty experienced by the State Departments of Agriculture in obtaining suitably-trained investigators, it is recommended that the Council should adopt a scheme which will enable the Universities to attract students to the faculties of agriculture and veterinary science by notifying that appointments will be available for suitable men on the completion of their University course, or towards the completion of such.

7. We consider that the ways in which the Council of Scientific and Industrial Research can best serve Australia in the matter of agricultural advancement are by the establishment of a relationship of co-operation and collaboration with the State Departments of Agriculture, the Universities, and other institutions concerned with agricultural and live-stock interests.

It is understood that such co-operation would be compatible with the independence of individual organizations undertaking such research activities.

8. It is desirable that the phases of agricultural research indicated above should be carried out as far as possible with State Departments and Universities, and that such practice should be encouraged; but when found impracticable it may be necessary to create new institutions.

9. To effect the desirable co-operation and necessary collaboration indicated throughout this memorandum, it is considered that the Council should bring into existence a Standing Committee on Agriculture, comprising the permanent heads of the State Departments of Agriculture and representatives of the Council, such Standing Committee on Agriculture to act as the advisory and consultative body on matters relative to agricultural and live-stock research undertaken by the Commonwealth.

NOTE.—Many of the investigations mentioned in this report, and particularly those in regard to animal genetics, involve prolonged research, from which results of economic importance cannot be expected for many years.

TROPICAL AGRICULTURAL RESEARCH STATION.

This Conference is of the unanimous opinion that the institution of a Tropical Agricultural Research Station in Australia is essential as a forerunner of the successful and economic development and settlement of the tropical parts of Australia and the Mandated Territories; and recommends the Council for Scientific and Industrial Research to approach the Commonwealth Government with a view to securing a special grant enabling the Council to accept the offer made by the Empire Marketing Board for the purpose of founding and maintaining such a station.

This Conference recommends that the Council for Scientific and Industrial Research take steps to secure an estimate of the probable cost and annual expenditure which would be involved in the erection, equipment, and conduct of such a Tropical Agricultural Research Station, with a view to securing a special grant from the Commonwealth Government.

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